

JVC

SERVICE MANUAL

VIDEO CASSETTE RECORDER **VHS**

HR-S10E



SPECIFICATIONS

Format	: VHS PAL standard
Recording system	: Rotary, slant azimuth two-head helical scan system
Video signal system	: PAL-type colour and CCIR mono-chrome signals
Tape width	: 12.65 mm
Tape speed	: 23.39 mm/sec.
Maximum recording time	: 240 min. with JVC E-240 video cassette
Temperature	
Operating	: 0°C to 40°C
Storage	: -20°C to 60°C
RF output signal	: UHF channels 36 - 40 (adjustable, preset to UHF channel 36 when shipped)
Power consumption	: 6 W (16 W with camera)
Power requirement	: 12 V ---
Camera connector output	: 12 V --- , 10 W maximum
Video	
Input	: 0.5 to 2.0 Vp-p, 75 ohms, unbalanced (using the provided dubbing connector)
Output	: 1.0 Vp-p, 75 ohms, unbalanced (using the provided dubbing connector)
Signal-to-noise ratio	: 43 dB (Rohde & Schwarz noise meter)
Horizontal resolution	: More than 250 lines

Audio	
Input	: Microphone: -67 dBs, 10 k-ohms, unbalanced Line: -20 dBs, 50 k-ohms, unbalanced (using the provided dubbing connector)
Output	: Earphone: Mini-jack Line: -6 dBs, 1 k-ohm, unbalanced (using the provided dubbing connector)
Signal-to-noise ratio	: More than 40 dB
Frequency range	: 70 Hz to 10,000 Hz
Dimensions	: 204(W) x 80(H) x 225(D) mm
Weight	: 2.4 kg

Provided accessories

Aerial cable x 2
Shoulder strap
Antenna selector
Dubbing connector
Connector cover
Dummy battery
Video cassette

Optional accessories

TU-S10EB/A Tuner/adaptor
NB-P4U High-capacity battery pack (1.2 AH)
NB-P3U Regular battery pack (0.75 AH)
BB-P3EG Battery charger
AC-P3EG AC power pack
AP-P3E Car battery adapter
CB-P10U System carrying case
CB-P11U Carrying bag (for outdoor shooting)
Video cassette

Design and specifications subject to change without notice.

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Important Safety Precautions

Prior to shipment from the factory, JVC products are strictly inspected to conform with the recognized product safety and electrical codes of the countries in which they are to be sold. However, in order to maintain such compliance, it is equally important to implement the following precautions when a set is being serviced.

●Precautions during Servicing

1. Locations requiring special caution are denoted by labels and inscriptions on the cabinet, chassis and certain parts of the product. When performing service, be sure to read and comply with these and other cautionary notices appearing in the operation and service manuals.

2. Parts identified by the  symbol and shaded () parts are critical for safety. Replace only with specified part numbers.

Note: Parts in this category also include those specified to comply with X-ray emission standards for products using cathode ray tubes and those specified for compliance with various regulations regarding spurious radiation emission.

3. Use specified internal wiring. Note especially:

- 1) Wires covered with PVC tubing
- 2) Double insulated wires
- 3) High voltage leads

4. Use specified insulating materials for hazardous live parts. Note especially:

- 1) Insulation Tape
- 2) PVC tubing
- 3) Spacers
- 4) Insulation sheets for transistors

5. When replacing AC primary side components (transformers, power cords, noise blocking capacitors, etc.) wrap ends of wires securely about the terminals before soldering.

6. Observe that wires do not contact heat producing parts (heatsinks, oxide metal film resistors, fusible resistors, etc.)

7. Check that replaced wires do not contact sharp edged or pointed parts.

8. When a power cord has been replaced, check that 10–15 kg of force in any direction will not loosen it.

9. Also check areas surrounding repaired locations.

10. Products using cathode ray tubes (CRTs)

In regard to such products, the cathode ray tubes themselves, the high voltage circuits, and related circuits are specified for compliance with recognized codes pertaining to X-ray emission. Consequently, when servicing these products, replace the cathode ray tubes and other parts with only the parts specified. Under no circumstances attempt to modify these circuits. Unauthorized modification can increase the high voltage value and cause X-ray emission from the cathode ray tube.

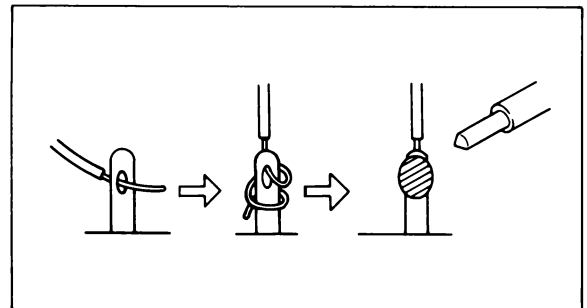


Fig. 1

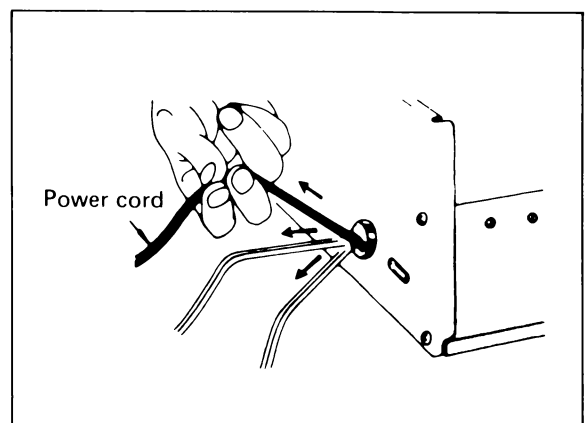


Fig. 2

11. Crimp type wire connector

In such cases as when replacing the power transformer in sets where the connections between the power cord and power transformer primary lead wires are performed using crimp type connectors, if replacing the connectors is unavoidable, in order to prevent safety hazards, perform carefully and precisely according to the following steps.

1. Connector part number : E03830-001
2. Required tool : Connector crimping tool of the proper type which will not damage insulated parts.
3. Replacement procedure
 - 1) Remove the old connector by cutting the wires at a point close to the connector.
Important : Do not reuse a connector (discard it).
 - 2) Strip about 15 mm of the insulation from the ends of the wires. If the wires are stranded, twist the strands to avoid frayed conductors.
 - 3) Align the lengths of the wires to be connected. Insert the wires fully into the connector.
 - 4) As shown in Fig. 6, use the crimping tool to crimp the metal sleeve at the center position. Be sure to crimp fully to the complete closure of the tool.
 - 5) Check the four points noted in Fig. 7.

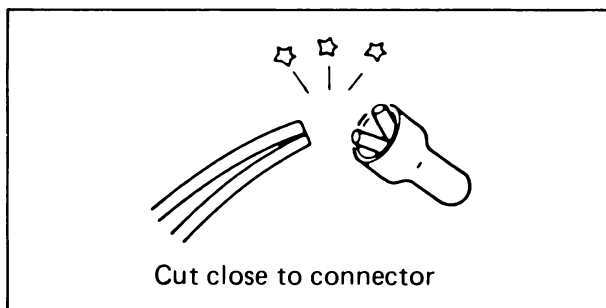


Fig. 3

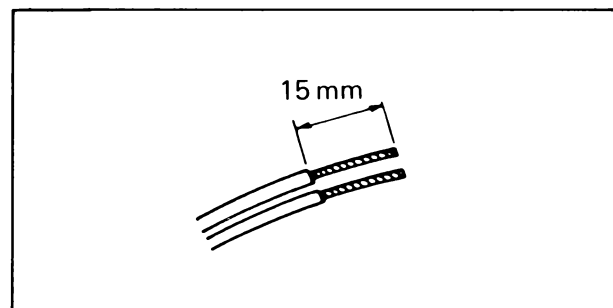


Fig. 4

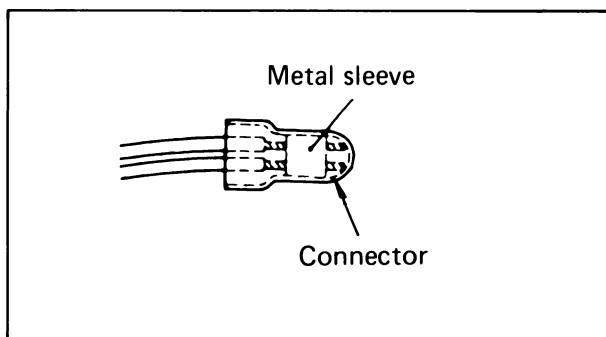


Fig. 5

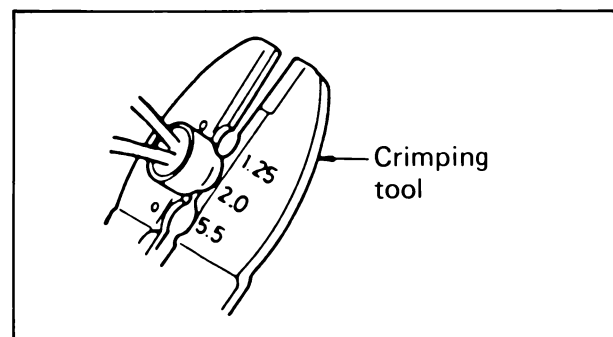


Fig. 6

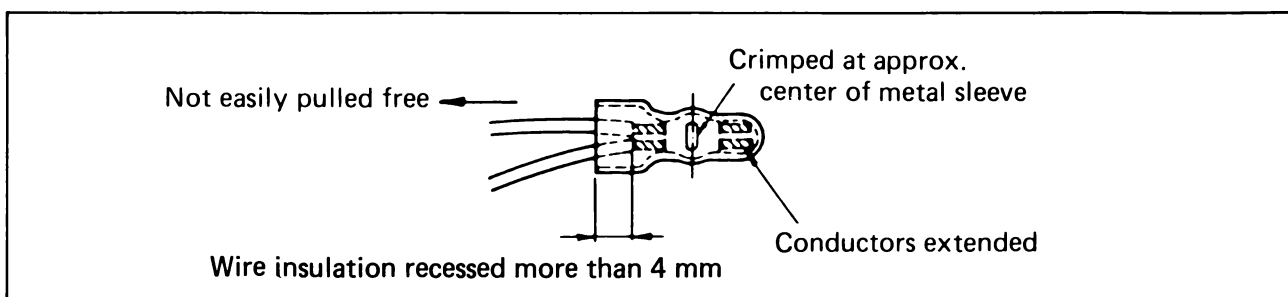


Fig. 7

● Safety Check after Servicing

Examine the area surrounding the repaired location for damage or deterioration. Observe that screws, parts and wires have been returned to original positions. Afterwards, perform the following tests and confirm the specified values in order to verify compliance with safety standards.

1. Insulation resistance test

Confirm the specified insulation resistance or greater between power cord plug prongs and externally exposed parts of the set (RF terminals, antenna terminals, video and audio input and output terminals, microphone jacks, earphone jacks, etc.). See table below.

2. Dielectric strength test

Confirm specified dielectric strength or greater between power cord plug prongs and exposed accessible parts of the set (RF terminals, antenna terminals, video and audio input and output terminals, microphone jacks, earphone jacks, etc.) See table below.

3. Clearance distance

When replacing primary circuit components, confirm specified clearance distance (d),(d') between soldered terminals, and between terminals and surrounding metallic parts. See table below.

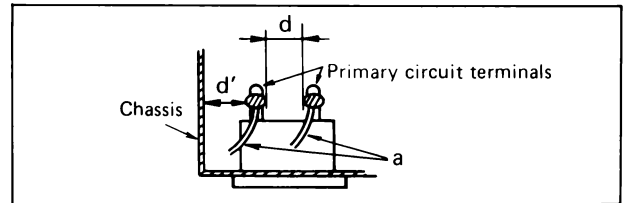


Fig. 8

Table 1: Ratings for selected areas

AC Line Voltage	Region	Insulation Resistance	Dielectric Strength	Clearance Distance(d),(d')
100 V	Japan	$\geq 1 \text{ M}\Omega/500 \text{ V DC}$	1 kV 1 minute	$\geq 3 \text{ mm}$
110 to 130 V	USA & Canada	— — —	900 V 1 minute	$\geq 3.2 \text{ mm}$
* 110 to 130 V 200 to 240 V	Europe Australia	$\geq 10 \text{ M}\Omega/500 \text{ V DC}$	4 kV 1 minute	$\geq 6 \text{ mm (d)}$ $\geq 8 \text{ mm (d')}$ (a: Power cord)

* Class II model only.

Note. This table is unofficial and for reference only. Be sure to confirm the precise values for your particular country and locality.

4. Leakage current test

Confirm specified or lower leakage current between B(earth ground, power cord plug prongs) and externally exposed accessible parts (RF terminals, antenna terminals, video and audio input and output terminals, microphone jacks, earphone jacks, etc.).

Measuring Method: (Power ON)

Insert load Z between B(earth ground,power cord plug prongs) and exposed accessible parts. Use an AC voltmeter to measure across both terminals of load Z. See figure and following table.

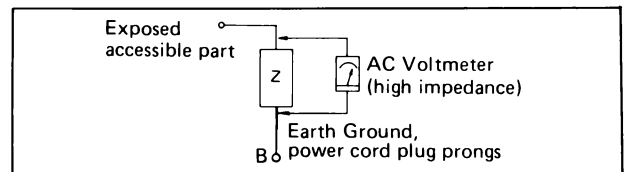


Fig. 9

Table 2: Leakage current ratings for selected areas

AC Line Voltage	Region	Load Z	Leakage Current (i)	Earth Ground (B) to:
100 V	Japan	$1 \text{ k}\Omega$	$i \leq 1 \text{ m A rms}$	Exposed accessible parts
110 to 130 V	USA & Canada	$0.15 \mu\text{F}$ and $1.5 \text{ k}\Omega$	$i \leq 0.5 \text{ m A rms}$	Exposed accessible parts
110 to 130 V 200 to 240 V	Europe Australia	$2 \text{ k}\Omega$	$i \leq 0.7 \text{ m A peak}$ $i \leq 2 \text{ m A dc}$	Antenna earth terminals
		$50 \text{ k}\Omega$	$i \leq 0.7 \text{ m A peak}$ $i \leq 2 \text{ m A dc}$	Other terminals

Note. This table is unofficial and for reference only. Be sure to confirm the precise values for your particular country and locality.

HR-S10E

INSTRUCTIONS

For reference, the text of the instruction booklet of this model is reproduced in the following pages.

Numbering of the pages also corresponds with that of the booklet.

Thank you for purchasing the JVC HR-S10E Video Cassette Recorder. It is an ultra-small, lightweight recorder, conforming to the VHS format. Combine with a JVC video camera to record live events anywhere, or combine with the matching TU-S10EB/A Tuner/Adapter (optional) to record TV programmes. Connection to the TU-S10EB/A is cable-less and very easy; a single action is all that is necessary to connect or disconnect the two units.

To obtain the best performance and greatest utilisation from your HR-S10E, read this instruction booklet carefully and completely.

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WARNING

1. This set is for exclusive use with the PAL colour system (system B and G).
2. SECAM (system B and G) colour programmes might be recorded in certain areas but there is no interchangeability of these recorded cassette tapes with other PAL-VHS recorders or SECAM-VHS recorders.
3. Please use the exclusive SECAM-VHS recorder in SECAM broadcasting areas.
4. Please use only PAL prerecorded cassette tapes or PAL signals which have been recorded with the PAL-VHS system.
5. For camera recording, connect a video camera built to the PAL standard.

WARNING:

TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS UNIT TO RAIN OR MOISTURE.

NOTE:

The rating plate (serial number plate) and the safety caution are on the bottom of the unit.

IMPORTANT: It is permissible to record television programmes only in the event that third party copyrights and other rights are not violated.



Only cassettes marked "VHS" can be used with this video cassette recorder.

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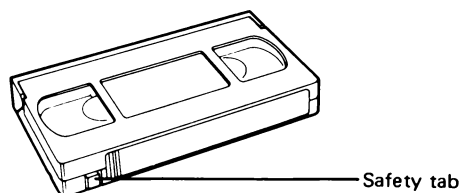
FEATURES

- Extremely compact and lightweight, easy to use video cassette recorder built to the VHS format.
- Flexible three-way power supply arrangement — exclusive Ni-Cad rechargeable battery pack, household AC and car battery.
- Feather-light touch pushbutton operation due to microprocessor-based full logic tape control.
- Direct cable-less connection to the matching TU-S10EB/A tuner with a single action.
- The infrared remote control unit (provided with the TU-S10EB/A) controls both units (HR-S10E and TU-S10EB/A) when they are connected.
- Shuttle search for quick picture search in both directions at about 9 times normal speed in either direction.
- Automatic backspace editing control system to minimise picture distortion between separately recorded segments.
- Simplified insert editing function permits new segments to be inserted on a pre-recorded tape with minimum distortion.
- Audio dubbing facility provided to record soundtrack on pre-recorded tapes.
- May be connected to most TV receivers due to the built-in RF converter.
- LCD (Liquid Crystal Display) tape counter with memory function.
- Recording standby mode lock circuit for clean assemble edits even after a power cut.
- Reverse playback at normal speed, plus still picture and still-picture advance playback.
- Automatic quick review function automatically displays the last second of the recording in the camera's viewfinder when the pause button is pressed during camera recording.
- Tape-to-tape dubbing either through the TU-S10EB/A's relevant connectors or using the provided dubbing connector.

PRECAUTIONS

Handling and storage

- Prevent inflammables, water and metallic objects from entering the unit.
- Do not disassemble or remodel the unit, as this will cause danger and malfunctioning.
- Do not use the unit when it is lightning in the vicinity and exercise special care not to allow the unit to become wet when shooting outdoors on rainy days.
- Do not place heavy objects on the unit.
- Do not apply shocks to the unit.
- Do not subject the unit to direct sunlight or place it near a heater for a long period of time, otherwise the cabinet may become deformed or the internal electronic components such as transistors may be damaged. Pay special attention to rising temperature in closed cars on hot summer days; the temperature in closed cars sometimes reaches as high as 80°C.
- Avoid using the unit under the following conditions:
 - Extremely hot or cold places
 - Near appliances generating strong magnetic fields
 - Moving from a cold to a warm place
 - Places subject to excessive humidity, dust or vibrations.



Video cassettes

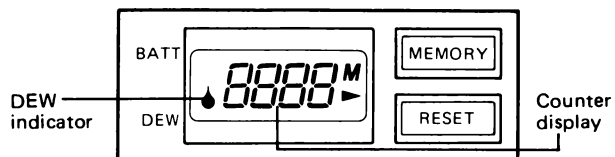
- The HR-S10E employs VHS-type cassettes only: E-240 for 4 hours, E-180 for 3 hours, E-120 for 2 hours, E-60 for 1 hour and E-30 for 30 minutes of recording.
- Video cassettes are equipped with a safety tab to prevent accidental erasure. When the tab is removed, recording cannot be performed. If you wish to record on a cassette whose tab has been removed, use adhesive tape to reseal the slot.

- Do not load and unload a video cassette successively without allowing the tape to run. This may slacken or damage the tape.
- An inverted cassette cannot be inserted.
- Do not touch the tape directly.
- Do not disassemble the video cassettes.
- Avoid exposing the cassettes to direct sunlight. Keep them away from heaters.
- Avoid extreme humidity, violent vibrations or shocks, strong magnetic fields (near a motor, transformer or a magnet) and dusty places.
- Place the cassettes in cassette cases and position them vertically.

Moisture condensation

- If you pour a cold liquid into a glass, water vapor in the air will condense on the surface of the glass. This is called moisture condensation.
- Moisture condensation on the head drum, one of the most crucial parts of the video recorder, will cause damage to the tape.
- Moisture in the air will condense on the recorder when you move it from a cold place to a warm place, after heating a cold room or under extremely humid conditions.
- The recorder is equipped with a moisture condensation prevention circuit which automatically heats the head drum according to the ambient temperature. In order for this circuit to operate, connect the TU-S10EB/A Tuner/Adapter to the recorder, plug the tuner's power cord into an AC outlet, and leave the recorder's POWER button in the OFF position.

- The DEW indicator of the recorder informs you that moisture has condensed inside the recorder. As long as this indicator remains flashing, the recorder cannot be operated.



- If this dew warning indication should happen when you have powered the recorder, the power is automatically switched off. In this case you must wait for a few hours until the indicator no longer flashes when power is reapplied.
- The moisture condensation prevention circuit consumes only a slight amount of power. However, if for some reason you are not using the system for a long period of time, it is advisable to remove the power cord from the AC outlet.

Maintenance

- When the cabinet is dusty, clean by gently wiping it with a soft cloth.
- Avoid the use of strong cleaning agents such as benzine or alcohol as they may damage the cabinet.

If malfunctioning occurs, stop using the unit immediately and consult your local JVC dealer.

IMPORTANT INFORMATION ON USING THE HR-S10E

Power supply

- Use the NB-P4U (high-capacity) or NB-P3U (regular) exclusive battery pack for battery operation.
- Use the TU-S10EB/A Tuner/Adapter or the AC-P3EG AC Power Pack for AC operation.
- Use the AP-P3E Car Battery Adapter to obtain power from a car battery.
- When changing the power supply from the TU-S10EB/A to other power units (battery pack, AC power pack, car battery adapter), press the POWER button to OFF and disconnect from the TU-S10EB/A.

Notes:

- If the POWER button fails to switch power on or off in case the TU-S10EB/A is used, unplug the AC power cord and, after a few seconds, plug it in once again.
- If the POWER button fails to switch power on or off in case a power supply unit is used instead of the TU-S10EB/A, remove the power supply unit and, after a few seconds, attach it once again.

Priority of input signals

The HR-S10E is not provided with an input select switch. So that you can record the specific source you intend, please refer to the following chart depending on the situation.

Video input signal priority

Video source	Priority
CAMERA	1
TU-S10EB/A or its VIDEO IN* (in use as a single-piece system)	2
VIDEO IN of the dubbing connector (in use as a separate unit)	

* Depends on the setting of the tuner's INPUT SELECT switch.

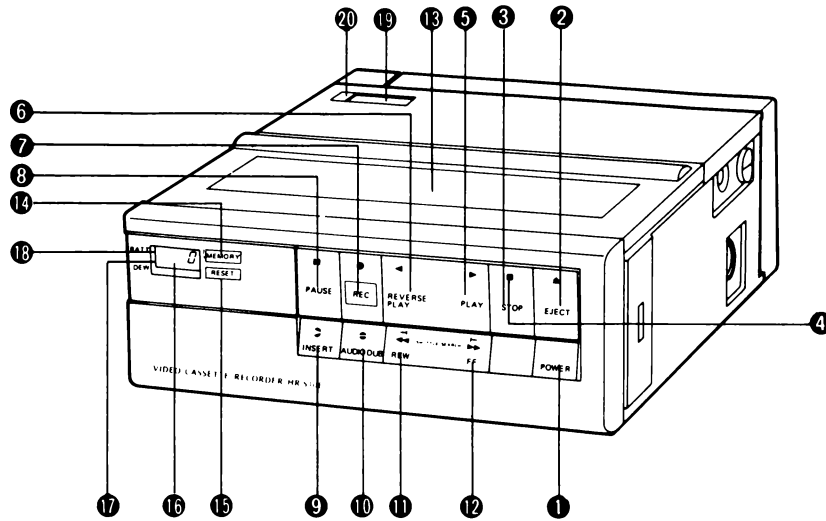
Audio input signal priority

Audio source	Priority
Microphone	1
Camera's external microphone	2
Camera's built-in microphone	3
TU-S10EB/A or its AUDIO* (in use as a single-piece system)	4
AUDIO of the dubbing connector (in use as a separate unit)	

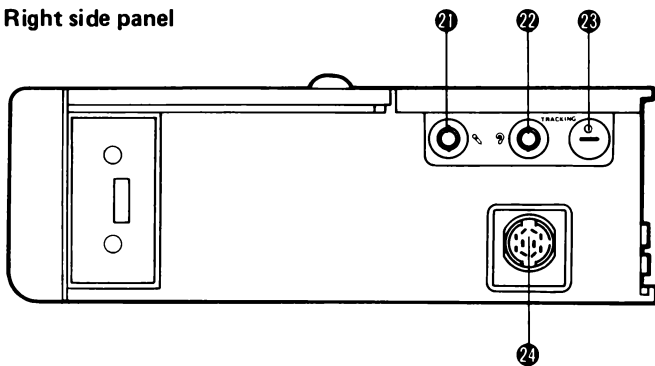
* Depends on the setting of the tuner's INPUT SELECT switch.

- When you record TV programmes (both video and audio) from the tuner, nothing should be connected to the CAMERA connector or the microphone jack. Moreover, be sure to set the INPUT SELECT switch of the tuner to TU.

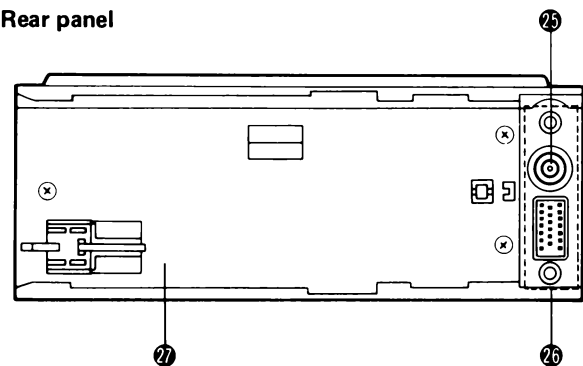
CONTROLS, INDICATORS AND CONNECTORS



Right side panel



Rear panel



❶ POWER button

Press to apply power to the recorder. The STOP indicator will light when power is switched on.

❷ Cassette EJECT button

Press for insertion or removal of the cassette, and the cassette housing will lift. The EJECT button functions only in the Stop mode with the STOP indicator lit.

❸ STOP button

To stop the tape.

❹ STOP indicator

Lights in the Stop mode; also serves as a power indicator.

❺ PLAY button

Press to play back the tape or cancel the Pause mode. Also press this button together with the REC button ❷ for recording or with AUDIO DUB button ❿ for audio dubbing.

❻ REVERSE PLAY button

To play back the tape in the reverse direction at the normal speed.

❼ Record button (REC)

Press together with the PLAY button ❺ for video and audio recording.

⑧ PAUSE button

Press to stop the tape temporarily to avoid recording of unwanted material or to view a still picture. The still picture can be advanced each time this button is pressed. Holding the button pressed in the Play mode continuously advances the still picture.

⑨ INSERT button

Press this button for insert editing. See pages 21 and 22.

⑩ AUDIO DUB button

Press this button together with the PLAY button ⑤ for audio dubbing. For more information see page 23.

⑪ REW/SHUTTLE SEARCH button

To rewind the tape, press this button while in the Stop mode. To view the speeded-up picture in the reverse direction for programme search, hold this button pressed while in the Play or Reverse Play mode.

⑫ FF/SHUTTLE SEARCH button

To fast forward the tape, press this button while in the Stop mode. To view the speeded-up picture in the forward direction for programme search, hold this button pressed while in the Play or Reverse Play mode.

⑬ Cassette housing

When the EJECT button is pressed, the cassette housing lifts.

⑭ MEMORY button

For automatic tape indexing in conjunction with the tape counter. When this button is pressed, "M" appears in the tape counter display. In this state, the tape will stop automatically in the Rewind and Fast Forward modes near the counter reading of "0". To cancel the memory function, press the MEMORY button once again.

⑮ RESET button

Press to reset the tape counter to "0".

⑯ Tape counter

Displays from "0" to "9999" as the tape runs. The tape direction indicator at the lower right-hand corner of the display ("▶" for forward or "◀" for reverse) shows the direction of tape running. In the Memory counter mode, "M" appears at the upper right-hand corner.

⑰ Condensation indicator (DEW)

When moisture has condensed inside the unit, this indicator flashes. See page 3.

⑱ Battery power warning indicator (BATT)

This indicator flickers to warn of insufficient battery power. See page 7.

⑲ Power unit release button (BATTERY)

Press this button to remove the attached battery pack, AC power pack or car battery adapter.

⑳ RF output channel adjustment screw cover

Open this cover by sliding it when resetting of the RF output channel is required. See page 10.

㉑ Microphone jack ()

Connect a microphone for sound recording.

㉒ Earphone jack ()

Connect an earphone for monitoring the sound during audio dubbing, camera recording or for private listening.

㉓ TRACKING control

Use this control to minimise noise bars, if observed, during playback.

㉔ CAMERA connector

Connect a JVC video camera directly to this connector using a 10-pin camera cable. (The camera's power consumption should not exceed 10 watts.)

㉕ RF output connector

Video and audio signals converted into RF signals (the type of signals of off-air broadcasts) are available from this connector during recording and playback. When the recorder is used separately, connect this terminal to the aerial terminal of a TV receiver for playback or monitoring.

㉖ Direct connector section

Connect the TU-S10EB/A Tuner/Adapter using connectors on this section. For connection to the A/V connector(s) of a television or a second recorder, connect the provided dubbing connector to this section. See page 20.

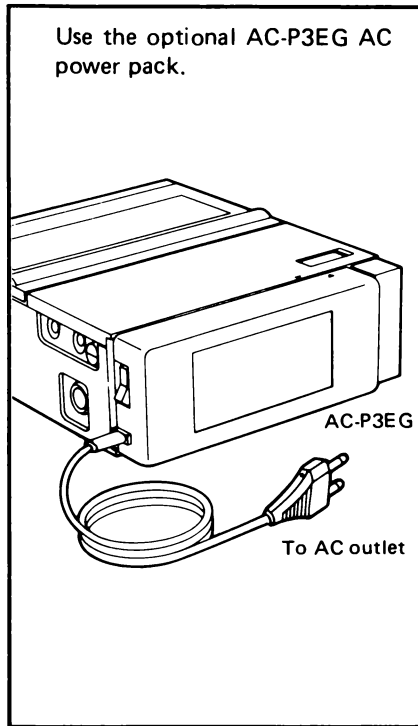
㉗ Power unit mount

Accepts the AC-P3EG AC Power Pack, NB-P4U/NB-P3U Battery Pack or AP-P3E Car Battery Adapter.

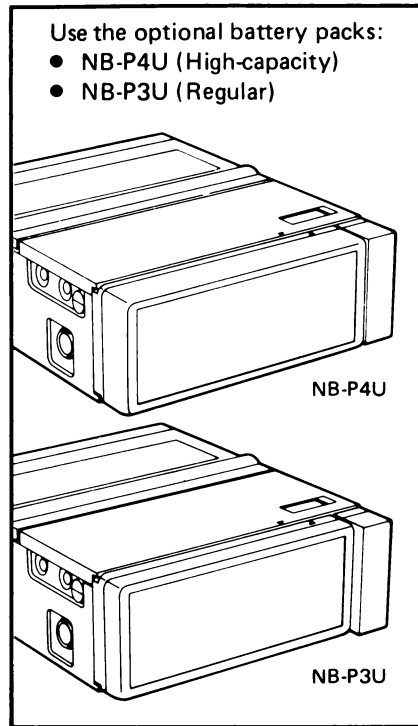
POWER SUPPLY SYSTEM IN THE PORTABLE CONFIGURATION

The convenient 3-way power supply system gives you a choice of the most appropriate power supply unit, depending on the application.

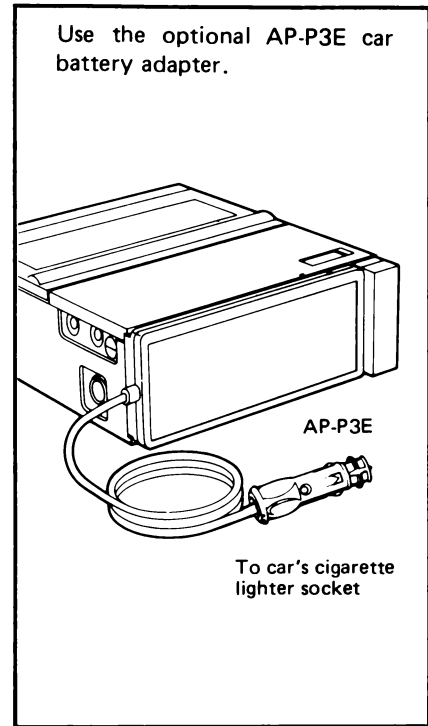
With AC power



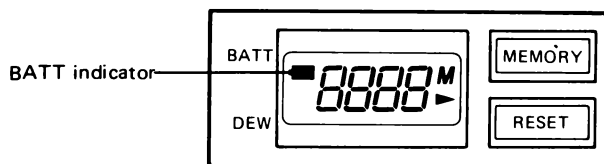
Where AC power is not available



In a car

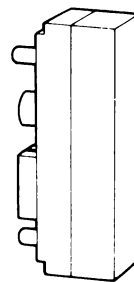


- Recharging procedure on page 11.



Note:

- If the BATT indicator in the counter display should flicker during operation via the battery pack, the battery power is nearing its end. After a short time, the power is automatically switched off. Recharge the battery pack or replace it with a charged one.

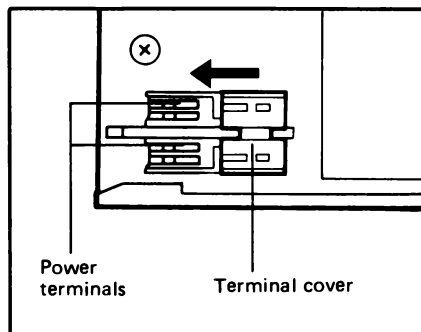


Connector cover (provided)

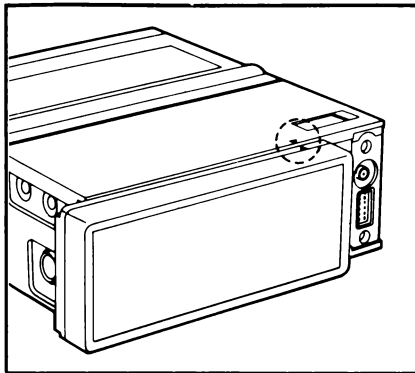
In outdoor applications or when just carrying the recorder about, attach the connector cover to the direct connector section to protect the connectors from dust and moisture.

ATTACHING AND REMOVING POWER SUPPLY UNITS

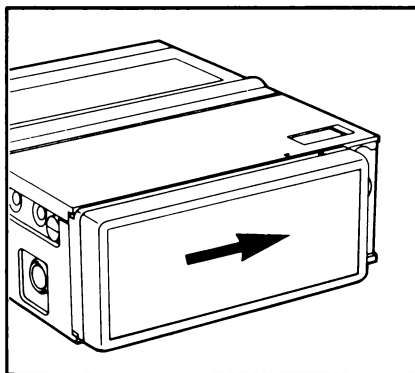
- The method of attachment and removal is identical for all power supply units.
- Be sure to switch off all power switches before attachment or removal.
- Check to see if the power terminals on the rear of the unit are covered with the terminal cover. If not, slide the terminal cover in the direction of the arrow.



To attach

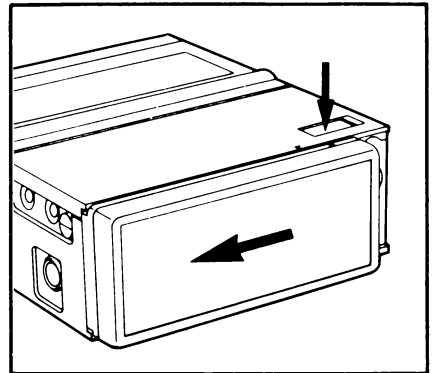


1 Align the marks.

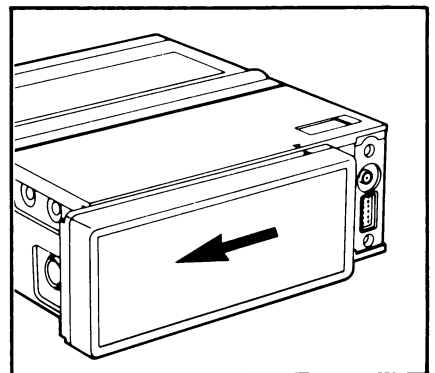


2 Slide until the unit locks in place.

To remove



1 While pressing the release button . . .



2 . . . slide off.

Note:

Check to see if power can be switched on or off with the POWER button. If not, remove the power supply unit and, after a few seconds, reattach it.

POWER SUPPLY AND CONNECTION IN THE HOME-DECK CONFIGURATION

The HR-S10E can be powered by the TU-S10EB/A Tuner/Adapter in the home-deck configuration. To power the recorder, simply connect it to the tuner in the following manner, plug the tuner's power cord into an AC outlet

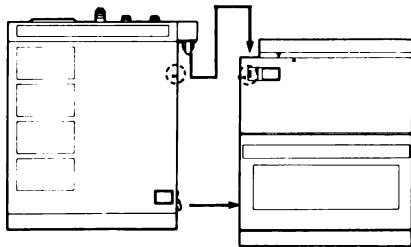
and press the recorder's POWER button.

To use the recorder/tuner combination to record off-air programmes and play them back, connect the tuner to the TV receiver as illustrated.

CONNECTING AND DISCONNECTING THE RECORDER FROM THE TUNER

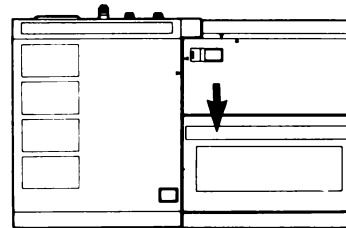
Connecting procedure

Place the recorder flush with the tuner so that the marks "►" and "◄" on either unit align with each other and hook the pawls on the tuner into the slots on the recorder. Then slide the recorder rearward until a click is heard so that the recorder's connector section plugs into the tuner's connector base correctly.



Disconnecting procedure

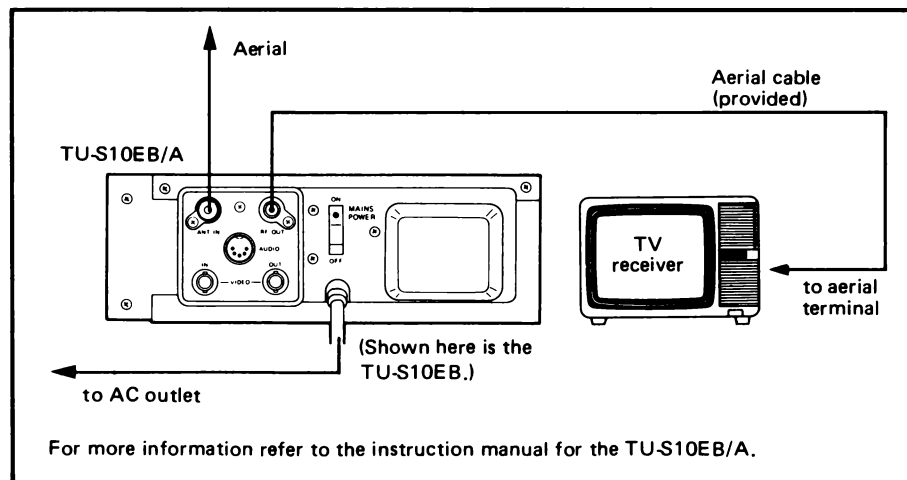
While pressing the RELEASE button of the tuner, pull the recorder straight forward.



CAUTION:

- Avoid carrying the two units in the connected state.
- When connecting or disconnecting the recorder, be careful not to apply pressure to its counter display.

CONNECTION TO A TV RECEIVER



Dummy battery (provided)



When the recorder is connected to the tuner for use as a single-piece system, install the dummy battery to occupy the indented area and give the system a balanced appearance.

Note:

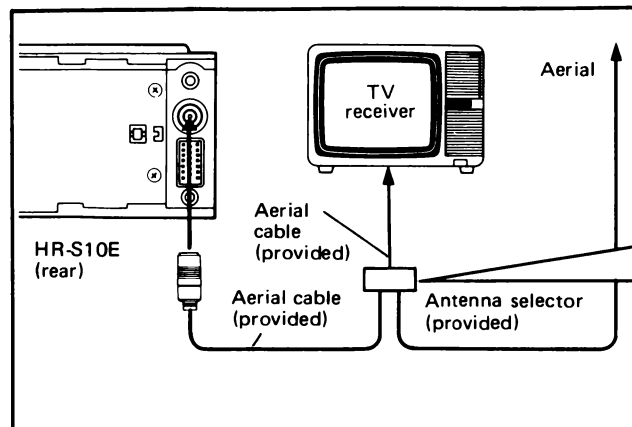
The dummy battery cannot be used as a real battery.

- In this state, the recorder can be connected or disconnected anytime at will. Before connecting or disconnecting the recorder from the tuner, make sure that the recorder's POWER button is in the OFF position.

PLAYBACK CONNECTION IN THE PORTABLE CONFIGURATION

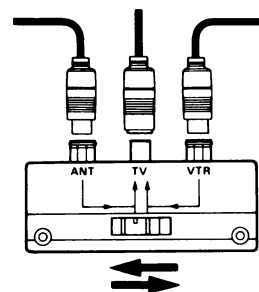
Connection to a TV receiver

The recorder can be directly connected to a TV receiver for playback.



- Remove the aerial from the TV receiver and connect the recorder via the antenna selector (provided) to the TV receiver's aerial terminal as illustrated.

How the antenna selector works



This connection lets you view both TV broadcasts and video tapes with a single TV receiver.

- Switch the antenna selector to "ANT" to view a broadcast TV programme.
- Switch the antenna selector to "VTR" to view a video tape. When checking what has just been recorded, also switch to "VTR". Then, turn the TV channel to your video channel.

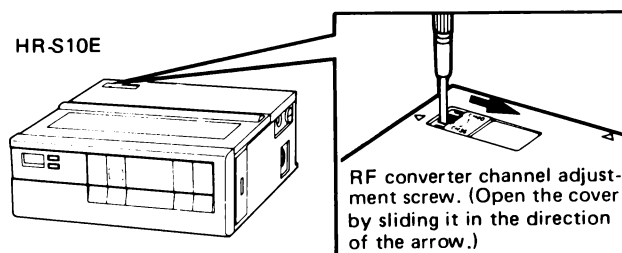
- Employ a fully-charged battery pack. For continuous playback, one fully-charged NB-P4U battery pack lasts for about 2 hours. Do not leave a video camera connected; it will consume power even if you are not using it.

VIDEO CHANNEL SETTING

The HR-S10E incorporates an RF converter for playback using a TV receiver. The output of the RF converter can be seen on the TV screen on a vacant channel which is not used for public broadcasting. The RF converter in this unit has been set to UHF channel 36 before shipment. If channel 36 is employed for broadcasting in your area, adjust the RF converter channel to one of the vacant channels between 36 and 40 as follows:

1. Adjust the TV receiver channel to one of the vacant channels.
2. Connect a video camera and switch the power on for the recorder.
3. While monitoring the camera signal on the TV screen, turn the RF converter channel adjustment screw in either direction so that the monitored picture comes in most clearly.

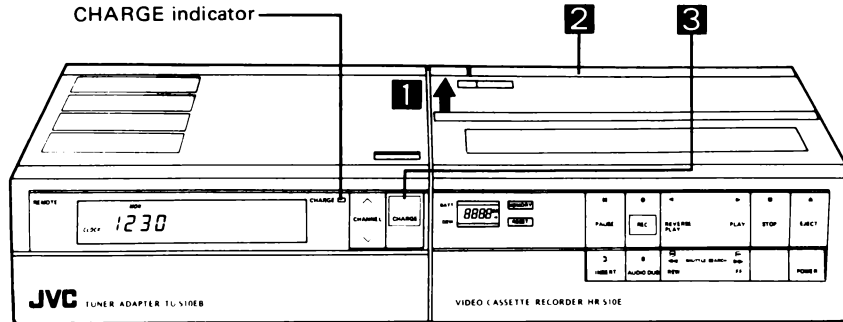
- Converter channel presetting is also possible using a pre-recorded cassette. Play back the cassette and adjust the screw to obtain the clearest picture on the TV screen.
- When you wish to view video cassette programmes, always set the TV receiver's channel selector to your VIDEO CHANNEL.



RF converter channel adjustment screw. (Open the cover by sliding it in the direction of the arrow.)

CHARGING THE BATTERY PACK

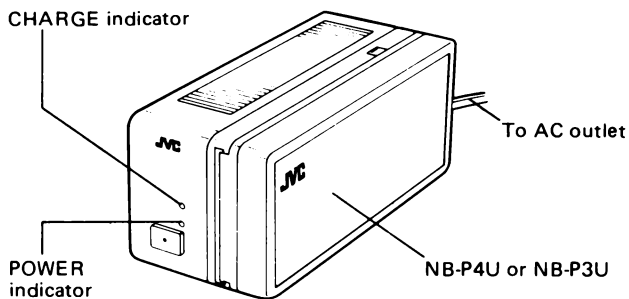
The TU-S10EB/A can recharge the battery pack attached to the recorder.



- 1 Connect the recorder to the TU-S10EB/A Tuner/Adapter.
 - Make sure that the power is switched off. If not, press the recorder's POWER button to OFF.
- 2 Attach the battery pack to the rear of the recorder.
- 3 Press the CHARGE button of the tuner.
 - The CHARGE indicator will light.
 - The NB-P4U will be charged in about 120 minutes.
 - The NB-P3U will be charged in about 80 minutes.
 - When charging is completed, the CHARGE indicator goes out.
 - During charging, the recorder cannot be operated; pressing the POWER button has no effect. If the recorder is to be used, press the tuner's CHARGE button to stop charging (the CHARGE indicator goes out) and then press the recorder's POWER button to ON. (The battery pack will not be fully charged.)

CAUTION

- Do not press the CHARGE button when no battery pack is attached to the recorder. Even with no battery pack attached, the Charge mode will be entered and the CHARGE indicator will light.
- Before attaching the battery pack to the recorder, make sure that the tuner's CHARGE indicator is off. If not, press the CHARGE button so that the indicator extinguishes.
- If the preset timer start time is reached during charging, charging is cancelled and timer recording starts. (Therefore, a "no light" condition of the CHARGE indicator does not necessarily mean that charging has been completed.) It is recommended that you adjust the time of charging to prevent this from happening.

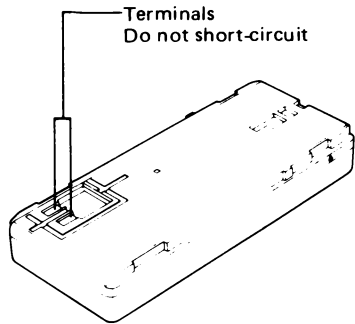


BB-P3EG battery charger (optional)

A more handy battery charger is optionally available so that you can take it wherever you go with the portable system. All you need is an AC outlet. Simply attach the battery pack to the charger in the same way as the battery pack is attached to the recorder. Charging time is about 90 minutes for a high-capacity battery pack and about one hour for a regular battery pack. For more details refer to the instruction manual for the BB-P3EG battery charger.

A WORD ON THE EXCLUSIVE NB-P4U/NB-P3U BATTERY PACKS (optional)

The NB-P4U/NB-P3U are nickel-cadmium batteries. Give attention to the following to make the most of their characteristics.



Temperature ranges:

The recharging time is based on room temperature of 20°C. The lower the temperature, the longer the recharging time.

For charging: 10°C to 35°C

For operating: -10°C to 40°C

For storing: -10°C to 30°C

Caution

The terminals are exposed on the bottom of the battery pack. DO NOT short-circuit these terminals.

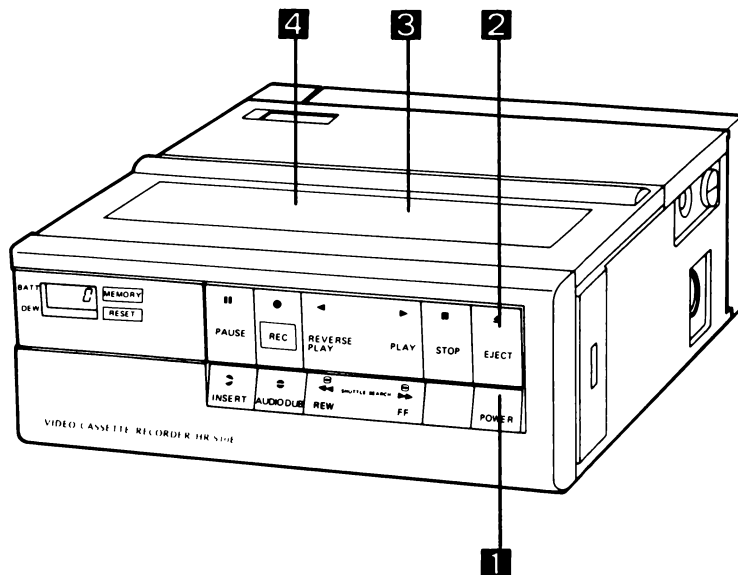
- If they are shorted, a great amount of current flows. This is not only very dangerous, but also makes the battery pack unusable.
- When transporting or storing the battery pack, exercise special care so that no metallic object touches the terminals.

When left attached to the recorder, the battery pack discharges naturally. When not in use, make it a rule to remove the battery pack.

The battery pack has been kept in the uncharged state for shipment. Therefore, before use, charge it.

- **Avoid repeated charging.**
Charging the battery pack repeatedly without using it may cause over-charging and shorten its service life.
- **Recharge using only a specified charger at 10°C to 35°C.**
Especially avoid recharging in a place under 10°C, as it may cause over-charging.
- **After use, store in a discharged condition.**
- **Do not store in places of high temperatures.**
Choose a dry place with temperatures between -10°C and 30°C for optimum storage.
- **The battery pack becomes warm immediately after being charged. This is not due to any defect.**
- Always keep the terminals clean. If they become dirty, wipe them with a piece of soft cloth.
- The fully charged NB-P4U battery pack provides power to the HR-S10E and a video camera (whose power consumption is about 6 watts) for about 60 minutes of continuous recording; the NB-P3U, for about 30 minutes.

LOADING AND UNLOADING A VIDEO CASSETTE



Loading

- 1 Press the POWER button to turn power on.
- 2 Press the EJECT button.
 - The cassette housing will lift.
- 3 Insert a cassette fully and correctly.
 - An inverted cassette cannot be inserted.
- 4 Press the cassette housing down to lock in place.
 - Be careful not to press the cassette housing with a cassette inserted midway.

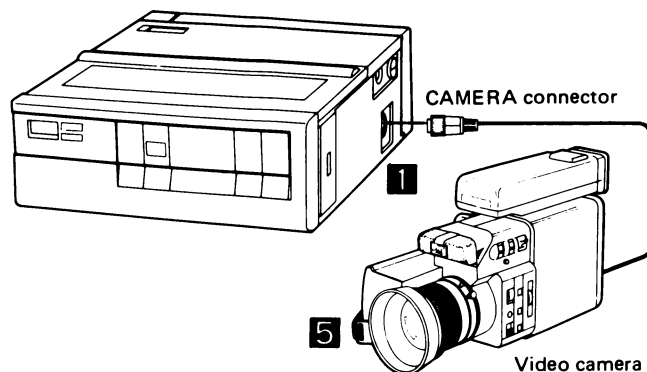
Unloading

- 1 Press the POWER button to turn power on.
- 2 Press the EJECT button.
- 3 Remove the cassette.
- 4 Press the cassette housing down until it locks.

Notes:

- Do not load and unload the cassette successively without allowing the tape to run at all. This would slacken the tape and thereby damage it.
- VHS video cassettes are equipped with a safety tab to prevent accidental erasure. When the tab is removed, recording cannot be performed. If you wish to record on a cassette whose tab has been removed, use cellophane tape to block the slot. Refer to pages 2 and 3 for more information regarding the video cassette.

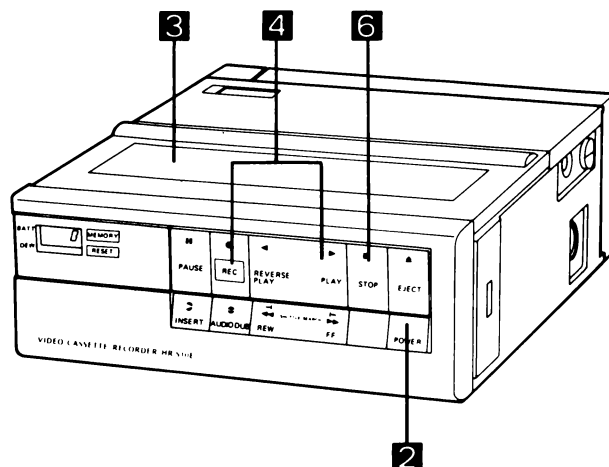
RECORDING WITH A VIDEO CAMERA



CAUTION:

Use a video camera whose power consumption does not exceed 10 watts.

- 1 Connect a video camera.
For powering the recorder, refer to pages 7, 8 and 9.
- 2 Press POWER. (The JVC GZ-S5E or GZ-S3E camera can control power on/off of the recorder.)
 - The recorder will start consuming power.
 - This also will start supplying power to the camera.
 If a monitor or TV receiver is connected to the recorder or if the electronic viewfinder is used, the picture can be monitored on their screen.
- 3 Load a cassette.



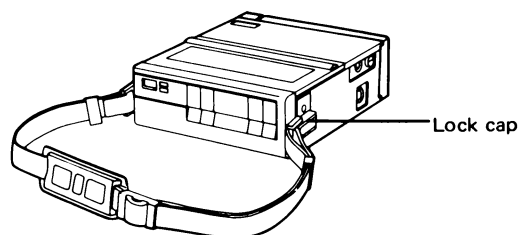
- 4 Press REC and PLAY simultaneously.
 - The recorder enters the Recording Standby mode. Starting or stopping of the tape is remote-controlled by the camera's start/stop switch; pressing the REC and PLAY buttons will not start the tape running.
- 5 Operate the camera's start/stop switch. (During recording, the REC indicator flashes.)
 - Now recording will start.
 - To stop recording temporarily, operate the start/stop switch to enter the Recording Standby mode.
- 6 To end recording, press STOP.

Notes:

- For camera operation refer to the instruction manual for the relevant camera.
- If you remain in the Recording Standby mode for longer than about 5 minutes with the power on, the power is automatically switched off to protect the tape.
- If the battery power becomes insufficient during battery operation, the BATT indicator flickers and then the recorder is automatically switched off. In this case, recharge the battery or replace it with a charged one.
- When a microphone is connected to the recorder's microphone jack, sound from the camera's built-in microphone cannot be recorded.

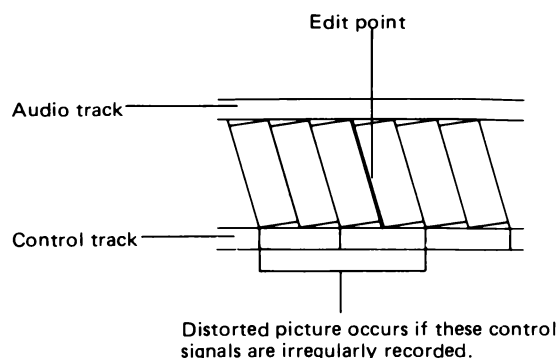
Attaching the shoulder strap

- Align the connector latches on each end of the strap with the slots of the recorder's strap retainers.
- Press in to firmly attach each strap connector.
- To remove the shoulder strap, first open the lock caps of each connector, then slide the connector latches out of the retainers.



CONVENIENT FACILITIES IN CAMERA RECORDING

Automatic editing function



The HR-S10E employs an automatic backspace editing mechanism to produce clean assembled recordings. When the tape is stopped in the Pause mode during recording, it is rewound (backspaced) automatically for about 1 second of programme time. When the Pause mode is released for recording, the backspaced section is played back while the control signals are being read and recording starts automatically when the previous and subsequent recordings are synchronised. As long as the starting and stopping of the tape is controlled by the camera's start/stop switch, clean edits can be obtained.

Recording pause mode lock facility

If you wish to stop recording longer than about 5 minutes to prepare for the next shot, turn the power off in the Record Pause mode so that the Stop mode will not be entered automatically and thereby the automatic editing function will not be cancelled.

The special recording pause mode lock facility keeps the tape loaded around the tape transport mechanism while power is off. When power is reapplied, recording will start directly from the Pause mode, allowing the automatic editing mechanism to function as it should.

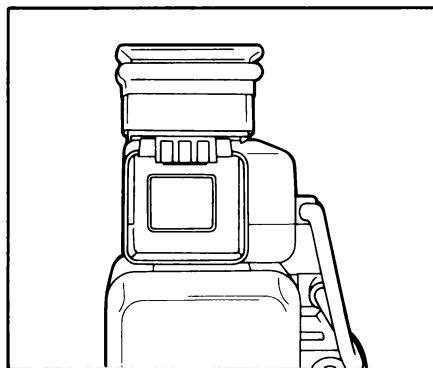
Note: Allow for about 10 seconds (warm-up time of the camera) before you start actual shooting after being in the Record Pause mode with power off.

Automatic quick review function

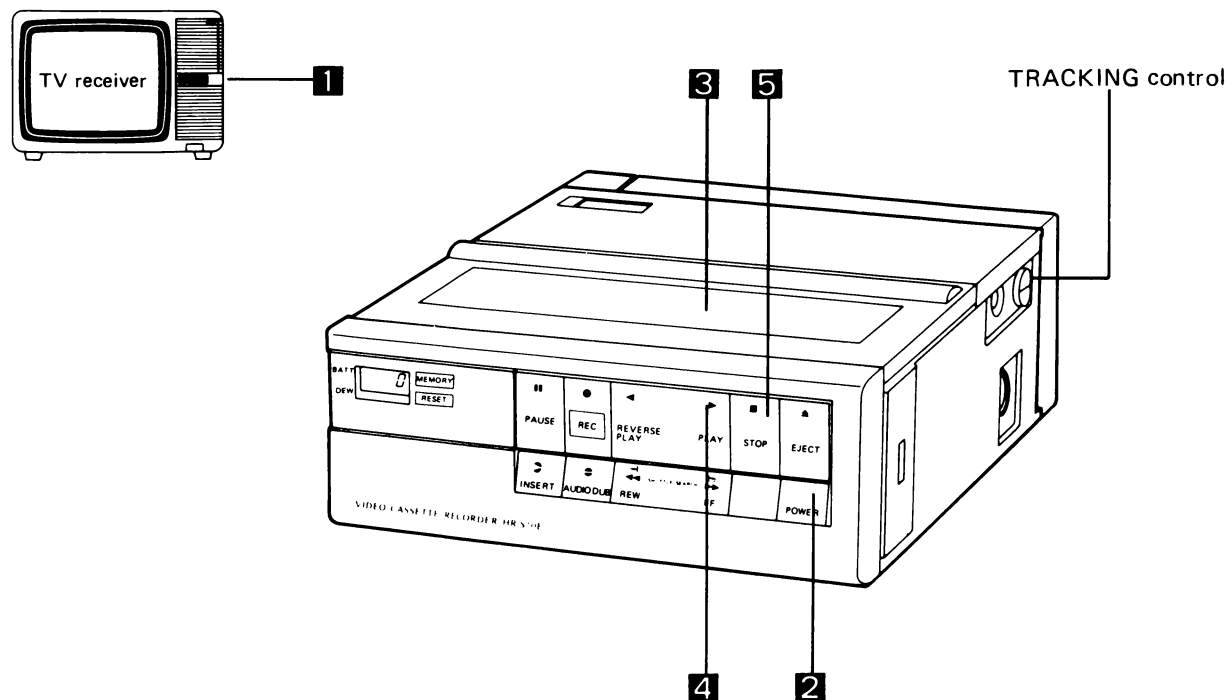
Each time you stop the tape in the Pause mode, the tape is automatically back-spaced for assemble editing, as fully described above. The automatic quick review function enables the reverse playback picture to be viewed during this backspacing period of about 1 second on the camera's viewfinder screen. Therefore, when you stop the tape with the camera's start/stop switch, you can always check the last second of your recording automatically.

Monitoring the playback on the camera's viewfinder

If a video camera equipped with an electronic viewfinder is used, the recorded material can be checked on the spot. For this purpose, first rewind the tape and press the PLAY button. The playback picture will be seen on the camera's viewfinder.



PLAYING BACK A VIDEO CASSETTE



- 1** Switch on the TV receiver.
Adjust the TV receiver's channel to your video channel.
(For connection to a TV receiver, refer to page 10.)
- 2** Press POWER to ON.
- 3** Load a pre-recorded cassette.
- 4** Press PLAY.
- 5** Press STOP at the end of the programme.

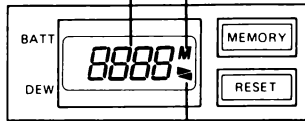
Note:

- Noise bars may appear on the screen if you play back a tape which was recorded using another recorder. In such cases, adjust the TRACKING control. Turn it in either direction to adjust the picture. After playing a particular tape, return the control knob to the centre position.

MORE TAPE HANDLING FACILITIES

Memory function indicator

Tape counter



Tape direction indicator

- ▶ : forward
- ◀ : reverse

Note:

- When the counter memory function is not needed, make "M" disappear by pressing the MEMORY button.

RESET button

Press to reset the tape counter to "0".

PAUSE button

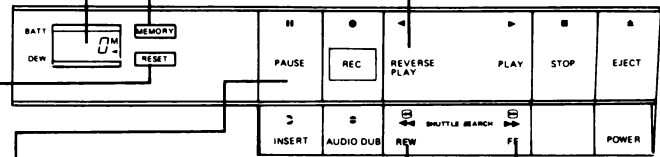
- To view a still picture, press this button in the Play mode. To resume normal playback, press the PLAY button.
- The still picture can be advanced each time this button is pressed. Holding this button pressed continuously advances the picture.
- Noise bars may appear or the picture may be unstable. This is not due to any defect of the unit.
- No audio is heard.
- Pressing the PAUSE button in the Reverse Play mode does not engage the Still mode. To view a still picture from this mode, first press the PLAY button and then the PAUSE button.

MEMORY button

- Press to engage the memory function. "M" will appear in the upper right corner of the display. The tape will stop automatically in the Rewind and Fast Forward modes near the counter reading of "0".
- To cancel the memory function, press the MEMORY button.

REVERSE PLAY button

- To view the tape in the reverse direction, press this button in the Stop mode.
- Noise bars may appear in reverse playback. This is not due to any defect of the unit.
- No audio is heard in reverse playback.



FF/SHUTTLE SEARCH button

- To fast forward the tape, press this button in the Stop mode.
- To search the tape in the forward direction, hold this button pressed in the Play mode.
- The search speed is about 9 times normal.
- No audio is heard.

REW/SHUTTLE SEARCH button

- To rewind the tape, press this button in the Stop mode.
- To search the tape in the reverse direction, hold this button pressed in the Play mode.
- The search speed is about 9 times normal.
- No audio is heard.

Notes:

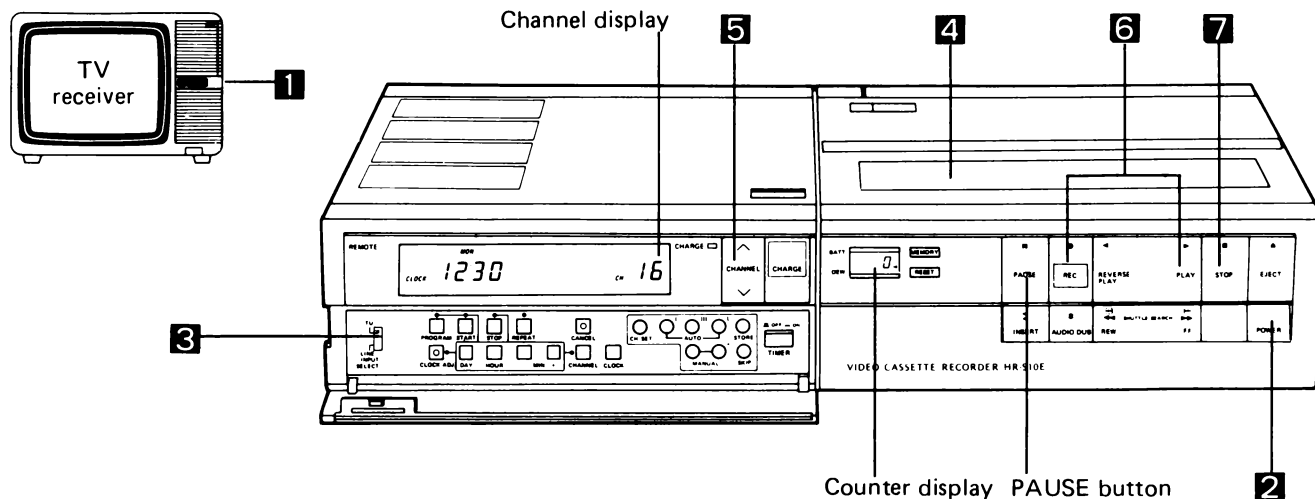
- When the Still mode continues for longer than about 5 minutes, the Stop mode will be entered automatically.
- In the special-effects playback modes, the picture may become unstable from time to time.

RECORDING TV PROGRAMMES USING THE TU-S10EB/A TUNER/ADAPTER

Basic concept: receive the desired TV programme with the tuner and operate the recorder for recording.

CAUTION:

When recording TV programmes, do not leave a camera or a microphone connected to the recorder.



1 Switch on the TV receiver.

- Adjust the TV receiver's channel to your video channel.

2 Press POWER.

3 Set INPUT SELECT to TU.

4 Load a cassette.

5 Select the channel you wish to record.

6 Press REC and PLAY simultaneously to start recording.

7 Press STOP at the end of the programme.

Notes:

- If the REC button cannot be engaged, check to see if the cassette safety tab has been removed. (See page 2.)
- If there is part of the programme you don't want to record, press the PAUSE button. To cancel the Pause mode, press the PLAY button.
- The Pause mode is released automatically after about 5 minutes in order to prevent tape damage and the Stop mode is engaged.
- The tuner's automatic channel lock mechanism prevents the selected channel from being altered during recording. Therefore, if you wish to change the channel during recording, first engage the Pause mode and then select a different channel.

Recording one TV programme while watching another

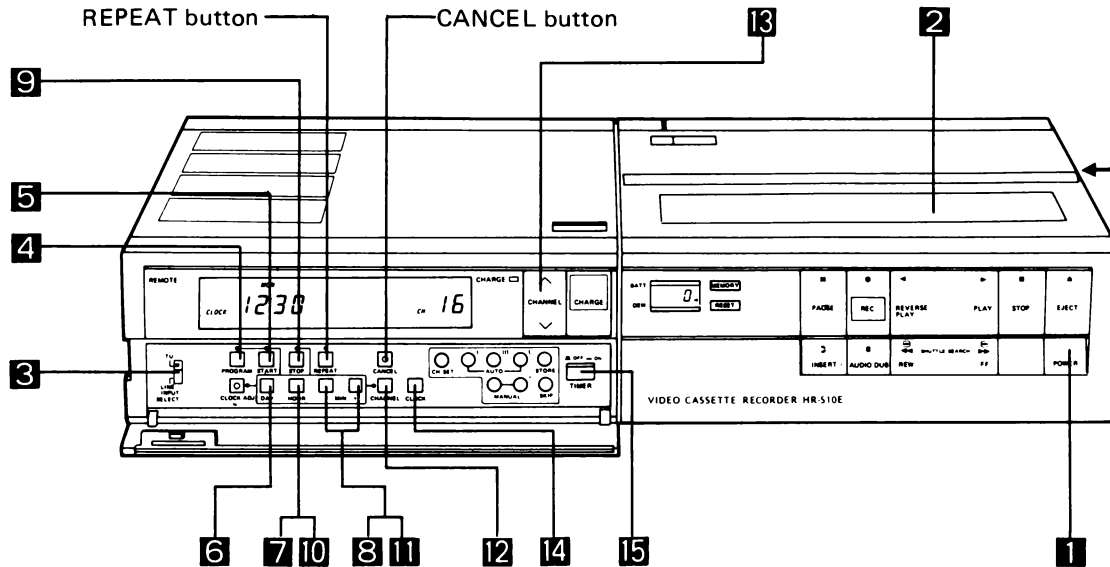
The recording procedures are exactly the same as above. The points to be remembered are:

- Select the channel you wish to record with the tuner's channel selector.
- Select the channel you wish to view with the TV receiver's channel selector.

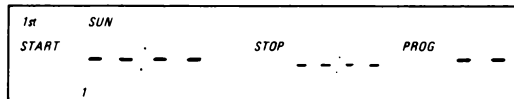
AUTOMATIC TIMER RECORDING USING THE TU-S10EB/A TUNER/ADAPTER

The tuner's 14-day/8-event programmable timer permits recording of preset channels on preset days, at preset times for preset lengths while you are away.

Do not leave a microphone or a camera connected.



- 1 Press POWER.
- 2 Load a cassette.
- 3 Set INPUT SELECT to TU.
- 4 Press PROGRAM.
 - The display will change to the Timer Set mode. You are ready to enter the data into No. 1 programme memory. If you want to change the programme number, press the PROGRAM button a required number of times.



- 5 Press START for day and switch-on time setting.
 - The START indicator will flash.
- 6 Press DAY to obtain desired "day" indication.
- 7 Press HOUR to obtain desired "hour" indication.
- 8 Press MIN+ or MIN- to obtain desired "minute" indication.

- 9 Press STOP for switch-off time setting.
 - The STOP indicator will flash.
- 10 Press HOUR to obtain desired "hour" indication.
- 11 Press MIN+ or MIN- to obtain desired "minute" indication.
- 12 Press CHANNEL for setting the channel from which you want to record.
 - The PROG indicator will flash.
- 13 Press CHANNEL "∧" or "∨" to obtain desired channel indication.
- 14 Press CLOCK to change the display to the Clock mode.
 - If no command is entered within about 60 seconds, all displays will be restored automatically.
- 15 Press TIMER to ON.
 - The TIMER indicator will light together with the numbers of the programmed memories.

For more information on the programmable timer refer to the instruction manual for the TU-S10EB/A.

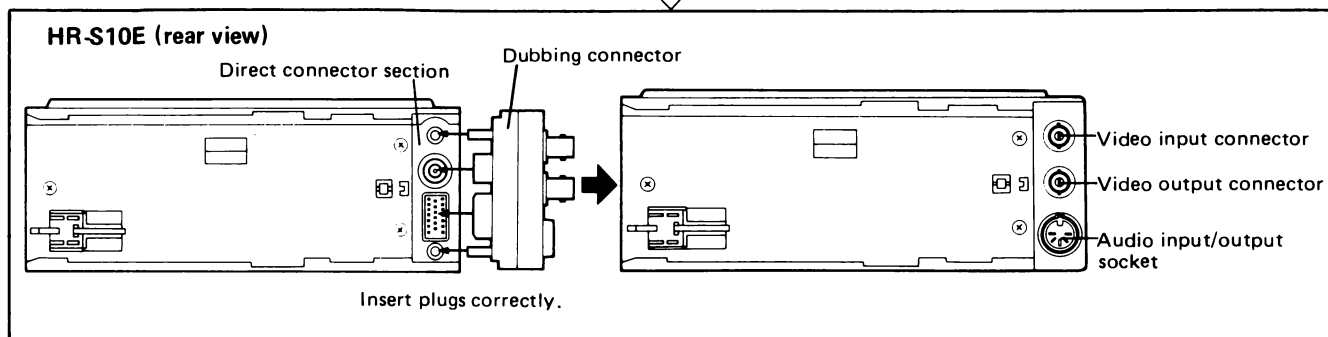
DUBBING CONNECTOR

(TAPE-TO-TAPE EDITING AND A/V CONNECTION TO A TELEVISION)

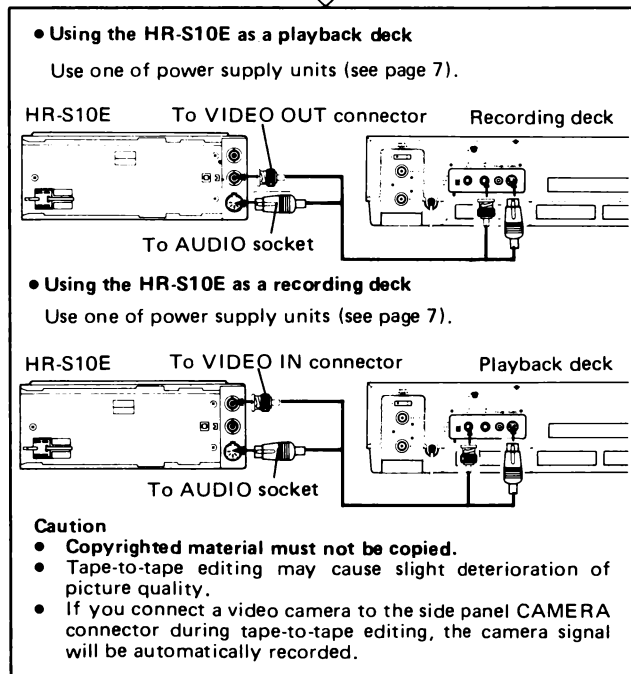
A dubbing connector is provided with the HR-S10E to enable it to be connected to another video recorder for editing, or to a television equipped with A/V input connectors, without using the TU-S10EB/A Tuner/Adapter.

- When the tuner is used in combination with the recorder, this dubbing connector is not needed. For editing operations using the tuner, refer to the instruction manual for the TU-S10EB/A.

Installing the dubbing connector to the recorder

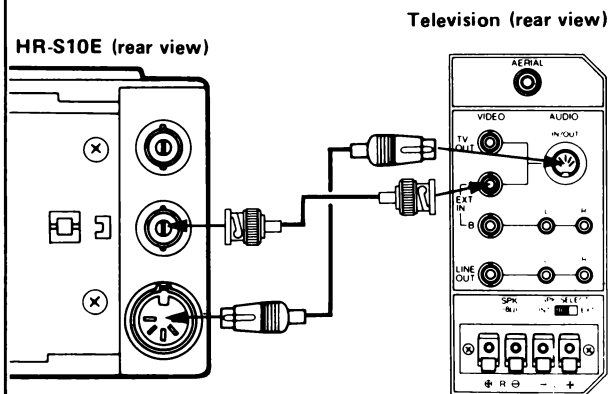


Connection for editing



Connection to a television via A/V connectors

This connection permits direct playback with a television equipped with A/V input connectors. As a power source, use the AC-P3EG, NB-P4U, NB-P3U or AP-P3E.



INSERT EDITING

Insert editing means recording a new scene into a section of pre-recorded tape so that a part of the original recording can be replaced with a new sequence without excessive picture distortion at edit-in and edit-out points. New video and audio signals to be inserted can come either from a video camera or another video cassette recorder, or from the tuner. Refer to page 4 for information on the priority of video and audio input signals.

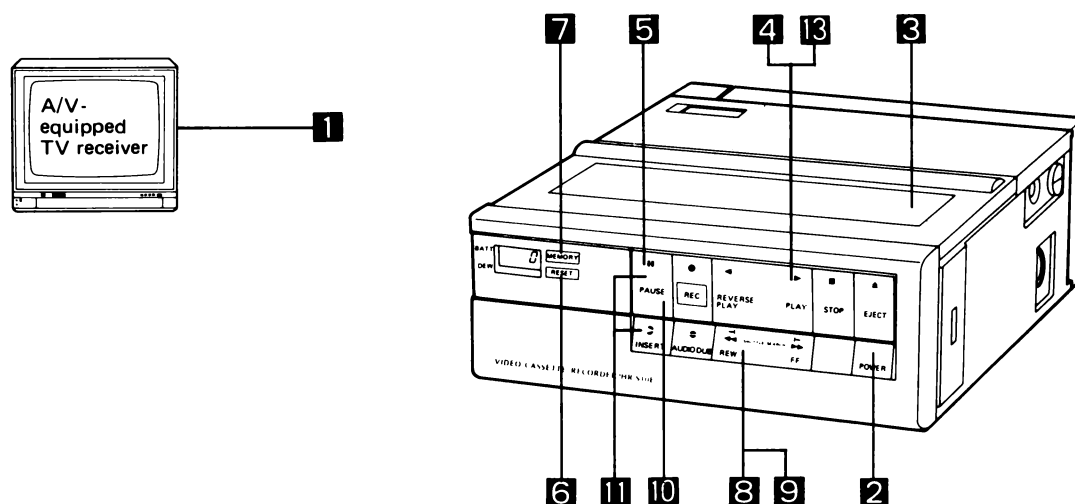
Connections

To insert video and audio signals from a camera, connect a camera to the recorder's CAMERA connector. See illustration on page 14.

To insert video and audio signals from another video recorder, connect a second video recorder to the HR-S10E via the dubbing connector as illustrated on page 20.

Note:

- In the configuration using the dubbing connector, start editing after the playback picture from the second recorder reaches its "clean" condition.



- 1** Switch on the TV receiver.
 - Engage the TV receiver in the VIDEO mode by pressing its TV/VIDEO button.
- 2** Press POWER.
- 3** Load a pre-recorded cassette.
- 4** Play back the tape to determine the edit-out point (the end of the tape section to be replaced).
- 5** Press PAUSE at the edit-out point.
- 6** Press RESET.
 - The tape counter will be reset to "0".
- 7** Press the MEMORY button to obtain "M" in the display.
- 8** Hold REW/SHUTTLE SEARCH pressed to determine the edit-in point (the beginning of the tape section to be replaced).
- 9** Release REW/SHUTTLE SEARCH at a point slightly past the desired edit-in point; normal playback will start.
- 10** Press PAUSE at the edit-in point.
- 11** Press PAUSE while holding INSERT pressed.
 - This engages the Insert Standby mode in which the input signal can be monitored on the TV screen; the still picture changes into the input signal that you are going to record.
 - The input sound signal can also be monitored.

12 Operate the source equipment properly.

- Play back on another recorder the tape programme to be inserted.
- Operate the camera so that it is in the locked running mode.

13 Press PLAY. Insert editing will start.

- 14** At the counter reading of "0", insert editing will stop automatically and the Play mode will be engaged. The INSERT indicator will go out.

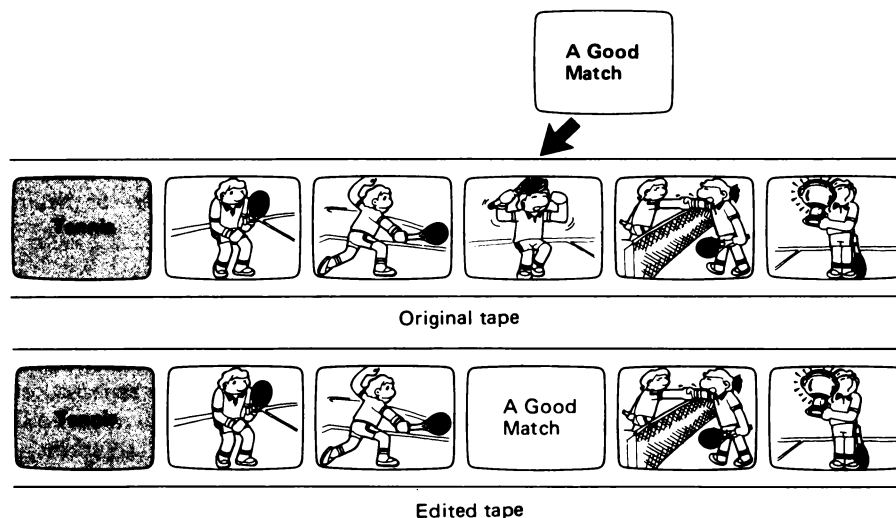
Notes:

- Do not use the STOP button to stop insert editing. If you press the STOP button, the tape stops and the Insert Edit mode is cancelled.
- The insert editing mechanism used in the HR-S10E has been developed for home use applications. It may happen that pictures slightly distort or colours are incorrect at the edit points. This is not due to any defect of the unit.

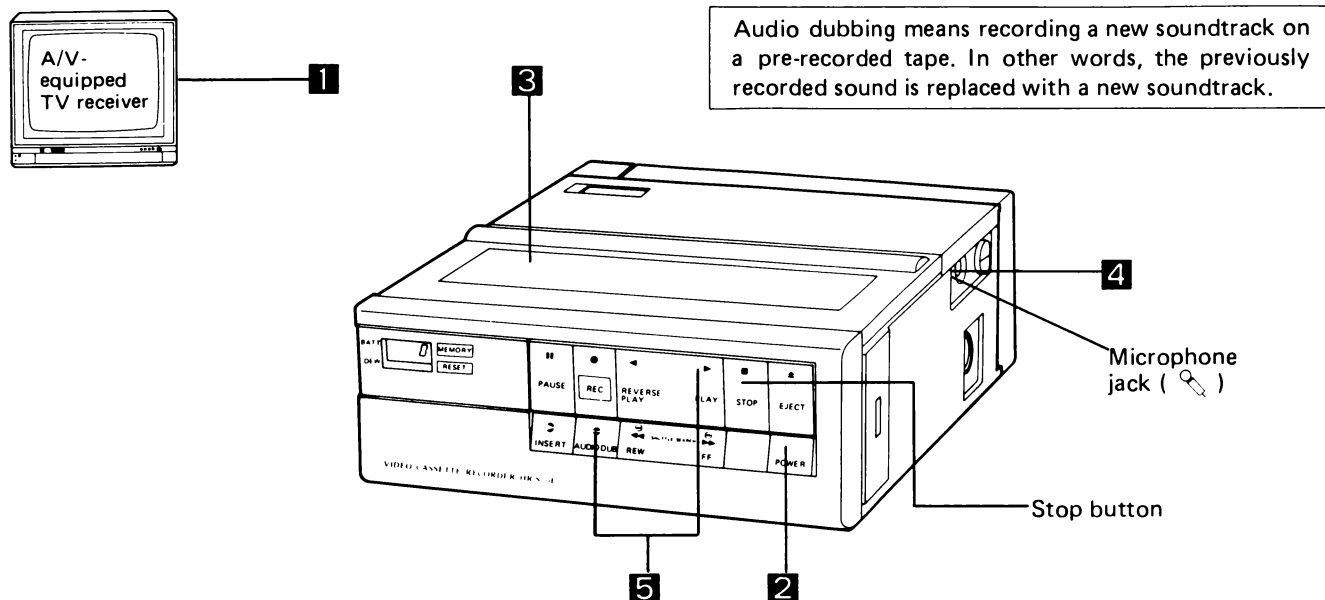
- If there is a non-recorded section on the tape, the Insert Edit mode will be cancelled automatically in that section (INSERT indicator will go out) and the Play mode will be engaged.
- Insert editing is not possible with non-recorded cassettes or cassettes whose safety tab has been removed.

Note:

- Insert editing is also possible with the recorder/tuner combination. For details refer to the instruction manual for the TU-S10EB/A.



AUDIO DUBBING



- 1** Switch on the TV receiver.
 - Engage the TV receiver in the VIDEO mode by pressing its TV/VIDEO button. For connection to a TV receiver, refer to page 20.
- 2** Press POWER.
- 3** Load a pre-recorded cassette.
- 4** Connect a microphone to the recorder's microphone jack ().
 - To record sound from a separate audio source, connect its LINE OUT connector to the dubbing connector's AUDIO connector (refer to page 20). Do not leave the microphone connected to the recorder in this case.
- 5** Press PLAY while holding AUDIO DUB pressed.
 - The AUDIO DUB and PLAY indicators will light and audio dubbing will start.
 - To stop audio dubbing, press the STOP button.

Note:

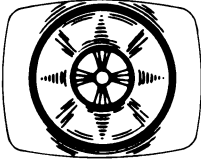
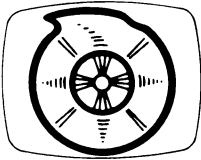
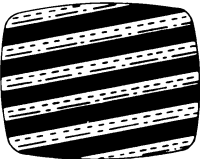
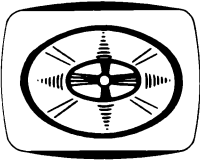
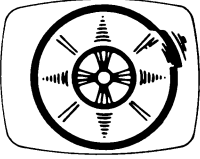
- Audio dubbing is also possible with the recorder/tuner combination. However, the TV sound from the tuner cannot be recorded in audio dubbing even when the INPUT SELECT switch is set to TU. For details refer to the instruction manual for the TU-S10EB/A.

Notes:

- Audio dubbing is not possible onto a cassette whose safety tab has been removed. See page 2.
- Use a high-impedance microphone.
- If whistling or howling is heard during audio dubbing, reduce the TV volume or move the microphone farther away from the TV. Recording is being performed even if sound is not heard from the TV receiver. If you want to monitor the sound being recorded, connect an earphone to the earphone jack ().
- The pause function facilitates audio dubbing. First play back the pre-recorded tape and press the PAUSE button at the point from which you wish to start audio dubbing. If necessary, adjust the point accurately by pressing the PAUSE button a few more times. Then press PLAY while holding AUDIO DUB pressed. This permits you to start audio dubbing exactly at the right point.

ADJUST YOUR TV RECEIVER WHEN . . .

If your TV receiver shows the following symptoms when the PAUSE button is pressed during playback, adjust the TV receiver first.

Symptom	Adjustment
Picture vibrates vertically. 	Turn the V-Hold knob slightly for stabilizing.
The upper portion of the picture drifts horizontally. 	Turn the H-Hold knob slightly for stabilizing.*
Picture rolls. 	Turn the H-Hold knob slightly for stabilizing.
Picture is flattened vertically. 	Inherent in your TV receiver.
Only a portion of the picture continues to flicker. 	Not adjustable. Inherent in your TV receiver.

HEAD CLEANING

- Picture playback may become blurred or interrupted while the TV programme received is clear. This does not mean that the recorded programme has been erased.
- Dirt accumulated on the video heads after long periods of use causes such troubles. In this case, head cleaning requiring highly technical care is necessary.

* For head cleaning, consult the nearest JVC dealer.

If the V-Hold and H-Hold knobs are not provided on your TV receiver, please consult your JVC dealer.

* If an unsatisfactory result is obtained, it is necessary to adjust the AFC circuit of the TV receiver.

IN CASE OF DIFFICULTY

What may initially appear to be trouble is not always a real problem. Make sure first . . .

Symptoms	Check points
No power is applied to the recorder with a power supply unit attached.	- Is a power supply unit (battery pack, AC power pack or car battery adapter) correctly attached? - Remove it once and reattach after a few seconds. - Is the battery pack charged?
No power is applied to the recorder/tuner combination.	- Is the power cord disconnected? - Connect it. - If it fails, reconnect it after a few seconds. - Is the rear panel MAINS POWER switch of the tuner (TU-S10EB only) set to ON? - Is the tuner's TIMER button pressed to ON? - Press it to OFF. - Is the recorder correctly connected to the tuner? - Is the recorder's POWER button in the ON position? - Is the tuner's CHARGE indicator lit? - Press the tuner's CHARGE button to turn the indicator off.
Playback picture does not appear while the tape is running.	- Is the TV receiver's channel selector set to the correct video channel? - Set to the RF converter channel. (See page 10.)
REC, AUDIO DUB or INSERT button cannot be engaged.	- Is the safety tab on the video cassette broken? - Reseal the slot with cellophane tape.
Tape stops in the Rewind or Fast Forward mode.	- Is the MEMORY button set to ON? - Press the MEMORY button to cancel the "M" mark in the display.
Noisy playback picture.	Adjust with the TRACKING control. Return the control to its centre position after playing back the particular tape.
Noise such as whistling or howling is heard from TV while camera recording or audio dubbing.	Move camera or microphone away from TV or reduce TV sound volume.
Playback sound is different from that recorded.	- Is a microphone plugged in? - Unplug it.
Timer recording impossible.	- Is the clock time correct or the timer correctly set? - Check. - Have you pressed the tuner's TIMER button to ON? - Is the PLAY indicator lit? - The loaded cassette may be without its safety tab. Press the TIMER button to OFF and, after powering the recorder, replace the cassette with a recordable one.
Camera recording impossible.	Is the camera correctly connected to the recorder?
Playback, reverse playback, rewind or fast forward impossible.	- Is the tape already wound to one end or the other? - Check the tape inside the cassette.

SPECIFICATIONS

Format	: VHS PAL standard	Audio	
Recording system	: Rotary, slant azimuth two-head helical scan system	Input	: Microphone: -67 dBs, 10 k-ohms, unbalanced Line: -20 dBs, 50 k-ohms, unbalanced (using the provided dubbing connector)
Video signal system	: PAL-type colour and CCIR monochrome signals	Output	: Earphone: Mini-jack Line: -6 dBs, 1 k-ohm, unbalanced (using the provided dubbing connector)
Tape width	: 12.65 mm	Signal-to-noise ratio	: More than 40 dB
Tape speed	: 23.39 mm/sec.	Frequency range	: 70 Hz to 10,000 Hz
Maximum recording time	: 240 min. with JVC E-240 video cassette	Dimensions	: 204(W) x 80(H) x 225(D) mm
Temperature		Weight	: 2.4 kg
Operating	: 0°C to 40°C	Provided accessories	
Storage	: -20°C to 60°C	Aerial cable x 2	
RF output signal	: UHF channels 36 – 40 (adjustable, preset to UHF channel 36 when shipped)	Shoulder strap	
Power consumption	: 6 W (16 W with camera)	Antenna selector	
Power requirement	: 12 V 	Dubbing connector	
Camera connector output	: 12 V  , 10 W maximum	Connector cover	
Video		Dummy battery	
Input	: 0.5 to 2.0 Vp-p, 75 ohms, unbalanced (using the provided dubbing connector)	Video cassette	
Output	: 1.0 Vp-p, 75 ohms, unbalanced (using the provided dubbing connector)	Optional accessories	
Signal-to-noise ratio	: 43 dB (Rohde & Schwarz noise meter)	TU-S10EB/A Tuner/adaptor	
Horizontal resolution	: More than 250 lines	NB-P4U High-capacity battery pack (1.2 AH)	
		NB-P3U Regular battery pack (0.75 AH)	
		BB-P3EG Battery charger	
		AC-P3EG AC power pack	
		AP-P3E Car battery adapter	
		CB-P10U System carrying case	
		CB-P11U Carrying bag (for outdoor shooting)	
		Video cassette	

Design and specifications subject to change without notice.



SECTION 1

GENERAL DESCRIPTION

1.1 GENERAL OUTLINE

The VHS system achieves very low tape consumption and uses low cost video cassette tape. Recording time in the standard mode has become 3 hours.

Increased recording time results from the narrow gap video heads, high sensitivity video tape and the slant azimuth recording head configuration which eliminates the need for a guard band between recorded tracks.

In addition, the VHS format takes into consideration special operating modes such as still picture, slow motion and speed playback.

Adoption of the VHS format presented several technical challenges. Foremost among these were obtaining high picture quality and high resolution despite the slow (4.9 meters per second) relative speed between the tape and video heads, improving signal to noise ratio (S/N), and preventing black to white reversal phenomena due to the short recording wavelength of $1.0\text{ }\mu\text{m}$. Also the $\pm 6^\circ$ azimuth angle of the video heads alone is not sufficient to eliminate crosstalk from the lowband converted color signal.

Steps for solving these difficulties included adoption of a nonlinear emphasis circuit and selecting the emphasis amount for optimum S/N. The reversal problem was overcome by using a double limiter circuit, while a phase shift system has been designed for eliminating color crosstalk.

The following discussion covers several main points of the VHS format.

1.2 MAGNETIC TAPE PATTERN

1.2.1 Standard

In the VHS format, two rotating video heads at $\pm 6^\circ$ azimuth angle are used for recording without a guard band. Fig. 1-1 indicates the recording pattern, while the pertinent values are listed in Table 1-1.

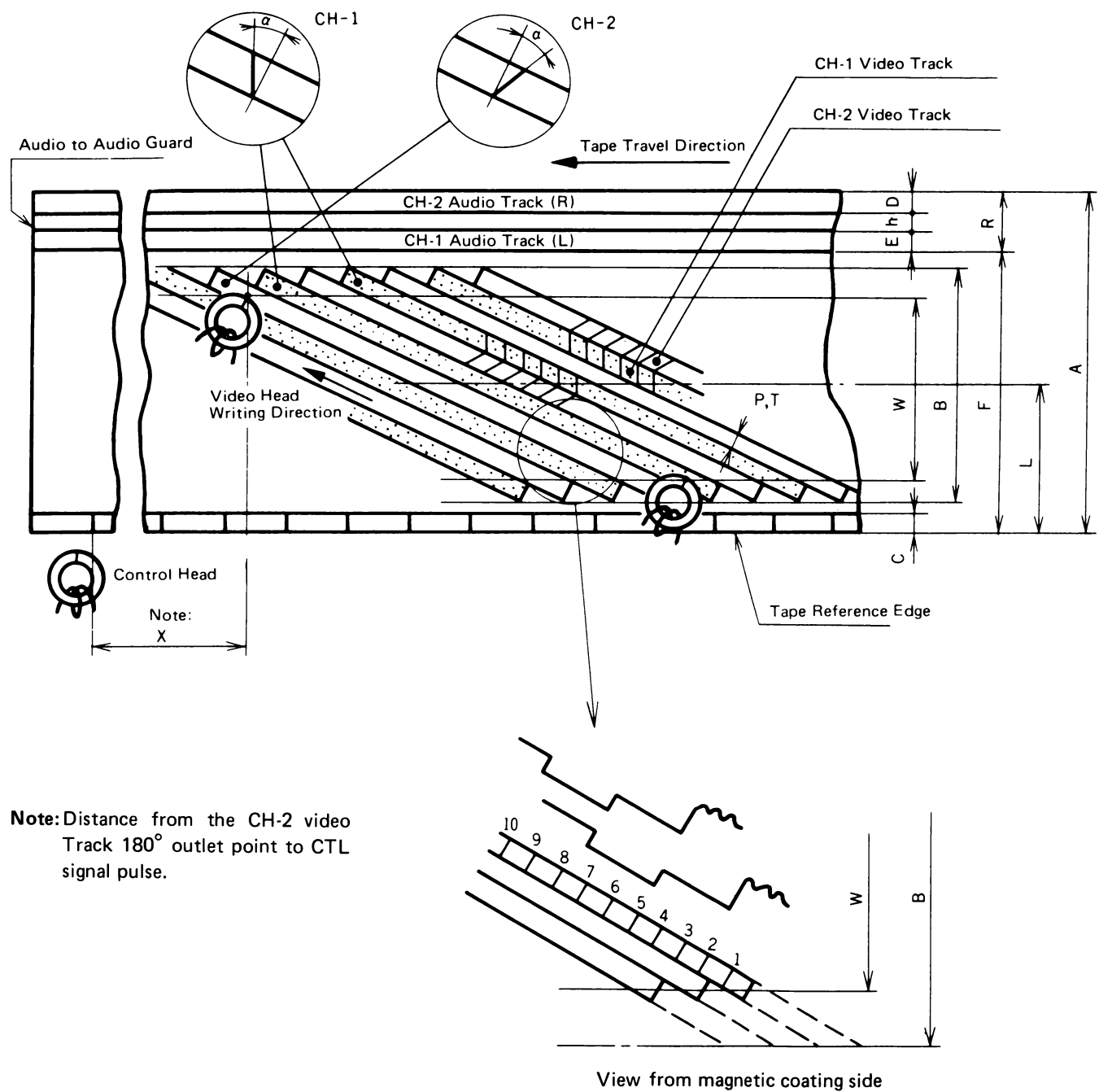


Fig. 1-1 Magnetic tape pattern

Items		Standard	Remarks
1. (A) Tape Width	mm	12.65 ± 0.01	(Upper Drum)
2. (Vt) Tape Speed	mm/sec	$23.39 \pm 0.5\%$	
3. (ϕ) Drum Diameter	mm	62 ± 0.01	
4. (Vh) Writing Speed	m/sec	4.85	
5. (P) Video Track Pitch	mm	0.049	
6. (B) Video Width	mm	10.60	Measured from reference edge
7. (W) Video Effective Width	mm	10.07	
8. (L) Video Track Center	mm	6.2	
9. (V) Video Track Width	mm	0.049	
10. (C) Control Track Width	mm	0.75	
11. (R) Audio Track Width	mm	1.0	Single track
12. (D) Audio Track Width	mm	0.35	CH-2 (R)
13. (E) Audio Track Width	mm	0.35	CH-1 (L)
14. (F) Audio Track Reference Line	mm	11.65	Measured from reference edge
15. (h) Audio to Audio Guard Width	mm	0.3	
16. (θ_0) Video Track Angle		$5^\circ 56' 7.4''$	(Stopped)
17. (θ) Video Track Angle		$5^\circ 57' 50.3''$	(Running)
18. (α) Video Head Gap Azimuth Angle		$6^\circ \pm 10'$	
19. (X) Positions of Audio and Control Head	mm	79.244	
20. () Positions of Front Edge of V-SYNC		$5 \sim 8H$	Inside the W bottom edge
21. () Tape Back-Tension		$30 \sim 45 \text{ g}$	At tape beginning and at the drum entrance

Table 1-1 Magnetic tape pattern

Note: Tests and measurements shall be made under the following conditions.

Temperature: $20^\circ\text{C} \pm 2^\circ\text{C}$, Relative humidity: $65\% \pm 5\%$

1.2.2 Horizontal Correlation

The azimuth head configuration removes crosstalk from most of the high frequency portion of the FM luminance signal, however, it is not able to fully eliminate crosstalk from the low frequency component of the lower sideband portion. This residual crosstalk is reduced by employing line correlation for the tape pattern.

Line correlation (or "H correlation") consists of arranging the horizontal sync signal positions of adjacent recorded tracks. Since this makes the frequencies of the main signal and crosstalk signal very close, the demodulated crosstalk amount becomes extremely low with respect to the main signal. The type of H correlation used in the VHS format is shown in Fig. 1-2.

In order to provide H correlation in the tape pattern, tape speed, head drum diameter and other factors must be decided. The adjacent track correlation in the VHS format is $1.5H$. This $1.5H$ difference is important not only for removing low frequency crosstalk from the luminance signal, but also for correcting color signal crosstalk in the SECAM system, for which phase shifting cannot be used.

Another advantage of H correlation is in avoiding skew distortion effects during special operating modes such as still, slow motion, 2x speed and shuttle search, when each video head traces two or more tracks. In these modes, the horizontal sync signals become played back at fixed intervals.

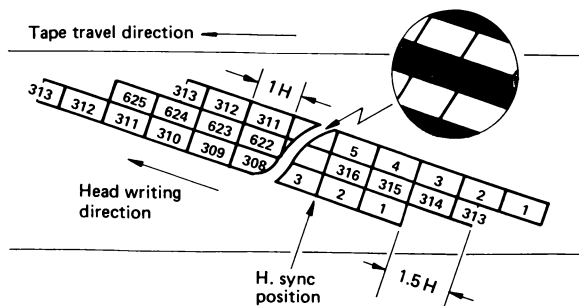


Fig. 1-2 VHS recording signal pattern

1.3 LUMINANCE SIGNAL RECORDING SYSTEM

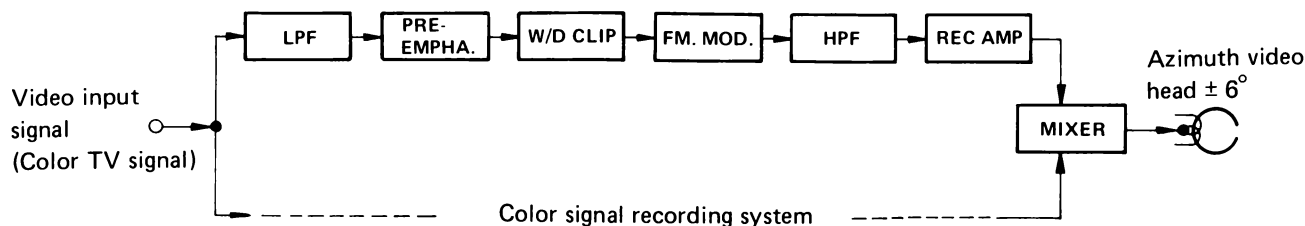


Fig. 1-3 Luminance signal recording system

Frequency modulation (FM) is used for the luminance signal recording system. A simplified block diagram of the system is shown in Fig. 1-3.

A lowpass filter (LPF) removes the color component and passes only the luminance component of the input color TV signal. At the next stage pre-emphasis circuit, the high frequency portion of the luminance signal is enhanced in order to improve S/N during FM recording. Since excess pre-emphasis could lead to black/white reversal due to the shortened recording wavelength, a white/dark clip circuit cuts the overshoot and undershoot components which exceed certain positive and negative levels.

The frequency modulator (FM MOD) converts the AM luminance signal to FM, which goes through a highpass filter (HPF) to the recording amplifier. These circuits amplify the signal with the proper frequency characteristic, after which it is mixed with the down converted color signal and supplied to the video heads.

1.3.1 Luminance Signal Recording Frequency Characteristic (LPF)

As shown in Fig. 1-4, when the video input is a color TV signal, a lowpass filter removes the color component and the luminance signal, with a bandwidth of from about 30 Hz to 3.0 MHz, is used. With some VHS models, when the input is a black and white TV signal, it bypasses the LPF, allowing a wider bandwidth to beyond 4 MHz.

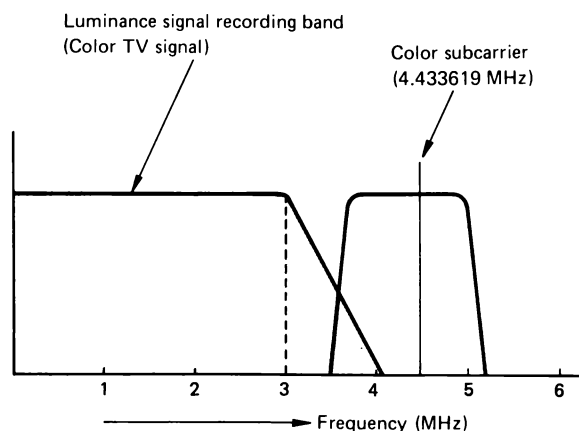


Fig. 1-4 Luminance signal recording band

1.3.2 Pre-emphasis Characteristics

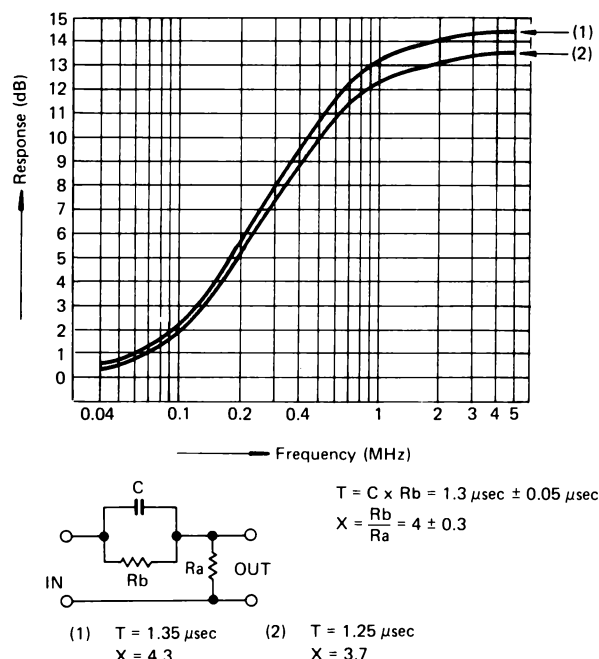


Fig. 1-5 Pre-emphasis characteristics

1.3.3 White and Dark Clip Level (See Fig. 1-6.)

White clip level : 160^{+10}_{-50} % measured from sync tip

Dark clip level : 40 ± 10 % measured from sync tip

Note: The level from sync tip to white peak is 100%.

1.3.4 FM Carrier Frequency and Deviation (See Fig. 1-6.)

Sync tip : 3.8 ± 0.1 MHz

White peak : 4.8 ± 0.1 MHz

Deviation : 1.0 ± 0.1 MHz

1.3.5 FM Signal Recording Frequency (HPF)

As indicated in Fig. 1-6, when the video input is a color TV signal, it goes through an HPF for vacating the area for the down converted color signal. With some VHS models, when the input is a B/W TV signal, the HPF can be bypassed to extend the bandwidth to the DC area.

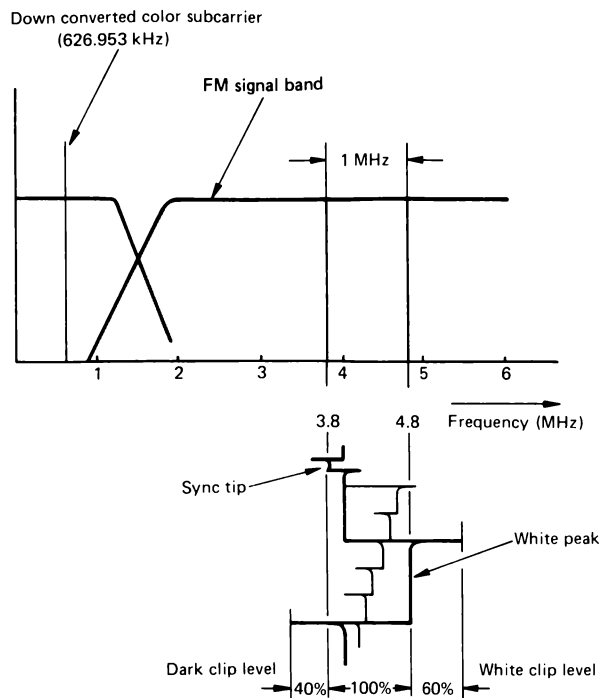


Fig. 1-6 Recording spectrum

1.3.6 FM Signal Recording Amp. Characteristics (REC AMP)

Current:

More than 3.8 MHz: Optimum saturation recording current

2 MHz : 3 ± 1 dB

1 MHz : 6 ± 1 dB

Less than 1 MHz : Flat characteristics

Note: 0 dB at 3.8 MHz

1.3.7 FM Signal Head Current (VIDEO HEAD)

It shall be within ± 1.5 dB of 4 MHz optimum recording current.

1.4 LUMINANCE SIGNAL PLAYBACK SYSTEM

This system functions to return the signals recorded on the tape to a form as close as possible to the video input signals. The simplified block diagram is shown in Fig. 1-7.

The low level FM signals played back by the two video heads are combined into a single FM signal by the switching amplifier. After amplification to the required frequency characteristic, a highpass filter attenuates the down converted color signal and passes only the FM luminance signal. This HPF has the same response as that of the recording system.

Variations in the playback FM signal level due to mechanical stretching and contraction of the tape, and irregularities in tape to head contact, are corrected by the limiter circuit. The signal is amplified more than 80 dB to permit precise demodulation. A double limiter circuit is employed in order to prevent black/white reversal effects.

In the following stages, the demodulator and lowpass filter return the luminance signal to its AM form. The de-emphasis circuit reverses the emphasis applied during recording. From this point, the signal goes to the mixer where it is mixed with the playback color signal to become the video output signal.

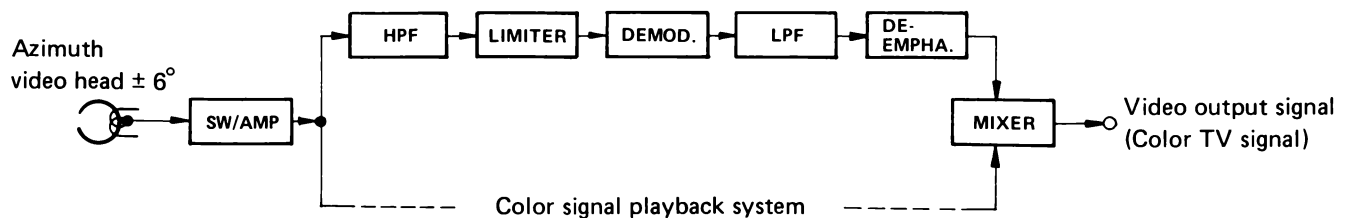


Fig. 1-7 Luminance signal playback system

1.5 COLOR SIGNAL RECORDING SYSTEM

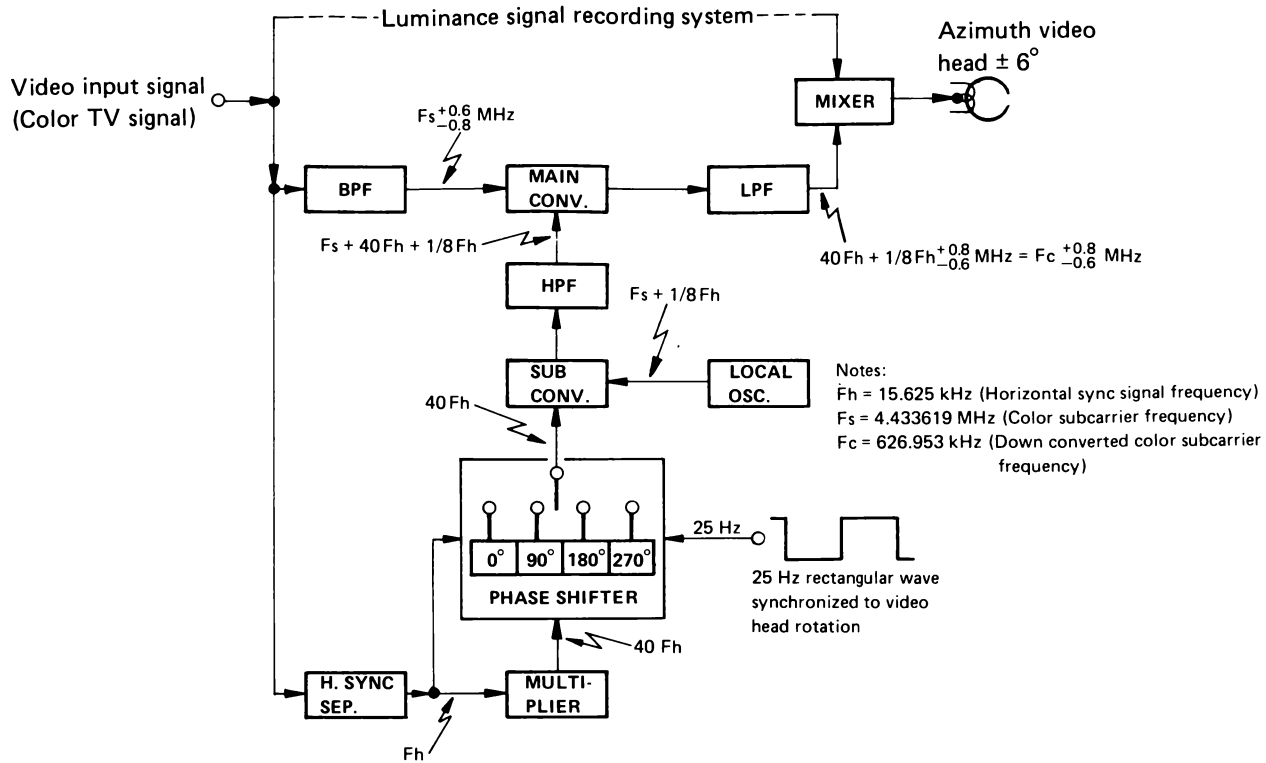


Fig. 1-8 Color signal recording system

This is a direct recording system using a down converted phase shifted color signal. The phase shift system removes color crosstalk which cannot be completely eliminated by the azimuth video heads. Fig. 1-8 illustrates a simplified block diagram of this system.

A bandpass filter (BPF) extracts the color component from the input video signal and supplies it to the main converter. At the same time, the input signal also goes to the horizontal sync separator, which supplies the 15.625 kHz (F_h) to the multiplier and phase shift circuits. Via the phase shifter, the $40 F_h$ CH-1 track component is supplied directly to the sub-converter, but the CH-2 component is delayed in phase 90° every line (1 H). A 25 Hz rectangular wave synchronized to the video head rotation is used for differentiating between the CH-1 and CH-2 components. Each line is also controlled by the F_h input.

The local oscillator produces the color subcarrier frequency 4.433619 MHz (F_s) + $1/8 F_h$ single frequency which goes to the sub-converter. At the sub-converter, the $40 F_h$ and ($F_s + 1/8 F_h$) are frequency converted to become ($F_s + 40 F_h + 1/8 F_h$). This is supplied through a highpass filter to the main converter. Also supplied to the main converter are the color signal $F_s \pm 0.6\text{ MHz}$ and carrier wave ($F_s + 40 F_h + 1/8 F_h$). These are down converted to become ($40 F_h + 1/8 F_h \pm 0.6\text{ MHz}$) which through a lowpass filter goes to the mixer for mixing with the FM luminance signal. The result is applied to the video heads.

In other words, the 4.433619 MHz (F_c) color subcarrier is converted to a low band of 626.953 kHz ($40 F_h + 1/8 F_h$). The down converted color signal is then recorded directly using the FM luminance signal as AC bias.

1.5.1 Color Crosstalk Correction by Phase Shift System

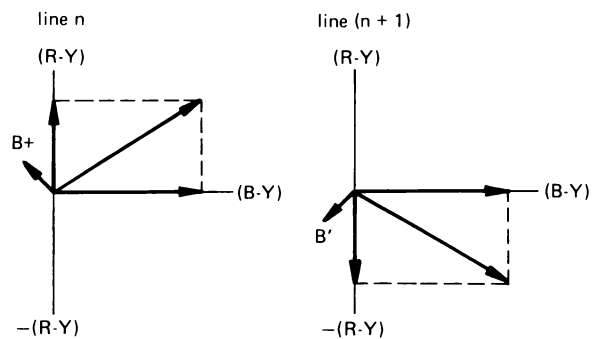


Fig. 1-9 Vector of color signal

A Synchronous quadrature modulation system is employed in which the phase of the color signal R-Y component is reversed every line in order to prevent transmission distortion.

The color signal indicated in Fig. 1-9 is converted to a low-band.

While the CH-1 track component is recorded with phase unchanged, the phase of the CH-2 track component is delayed 90° every line. Fig. 1-10 illustrates the principle of this phase shift system.

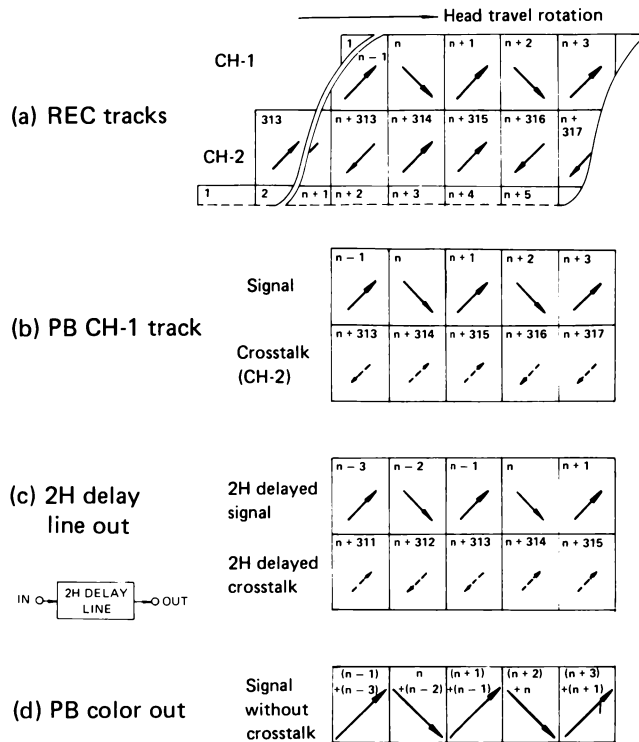


Fig. 1-10 Phase shift system

In the figure, (a) indicates the phase shifted recording pattern. Since the CH-1 head pattern is not phase shifted, the R-Y component phase becomes inverted every line. The phase of the CH-2 head pattern is delayed every line and this causes its R-Y component phase to become inverted every two lines.

During playback, when the CH-1 head picks up a portion of the CH-2 track signal, this becomes the crosstalk component. Phase shift is not required for the main signal from the CH-1 track, and this output is shown by (b). The dotted arrows indicate the crosstalk component and, as can be noted, the phase reverses every 2 lines.

Passing signal (b) through a 2H delay line yields signal (c). In comparing signals (b) and (c), the main signal phase is the same every line, but the crosstalk phase reverses. Therefore, by mixing signals (b) and (c), the crosstalk component of the adjacent track can be removed to result in the playback color signal (d).

In other words, the color signal can be considered in 2H units. It is recorded by the phase shift system and during playback, the signal through a 2H delay line is mixed to remove crosstalk.

Crosstalk in the playback color signal (d) effectively becomes zero, while the main signal is enhanced to improve S/N. Also, the CH-2 head playback phase is advanced 90° every line (opposite to recording), producing the same effect. A digital type system is used for phase shifting.

1.5.2 Down Converted Color Subcarrier Frequency

The color subcarrier frequency (F_s) can be expressed as:

$$F_s = (n - 1/4)F_h + 1/625 F_h = 283.75 F_h + 25 \text{ Hz } (n = 284) \\ = 4.433619 \text{ MHz}$$

A line offset system is used in which the subcarrier phase is delayed 90° every line. This avoids serious color noise when the color signal is displayed on a monochrome TV receiver. 25 Hz is added in order to prevent crosscolor.

As indicated in Fig. 1-10, the phase of the color signal R-Y component is inverted every horizontal line to compose a synchronous quadrature modulated signal. Fig. 1-11 shows this color signal spectrum.

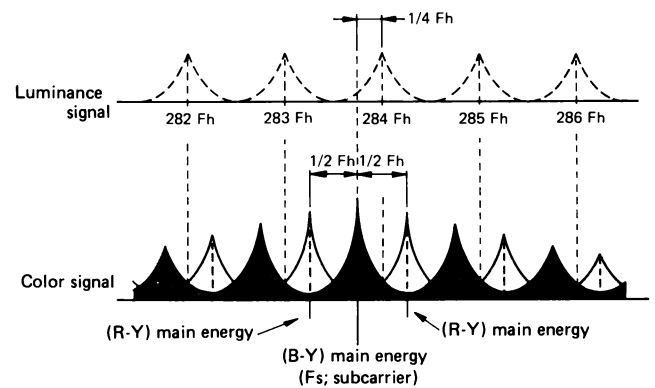


Fig. 1-11 Spectrum of color signal

In the phase shift system, the CH-1 component of the down converted color signal is distributed at $1/2 F_h$ intervals centered on the F_c (down converted color subcarrier) component. The CH-2 track component is delayed in phase 90° every line, deviated by $1/4 F_h$, and distributed at $1/2 F_h$ intervals centered on F_c . This spectrum is shown in Fig. 1-12.

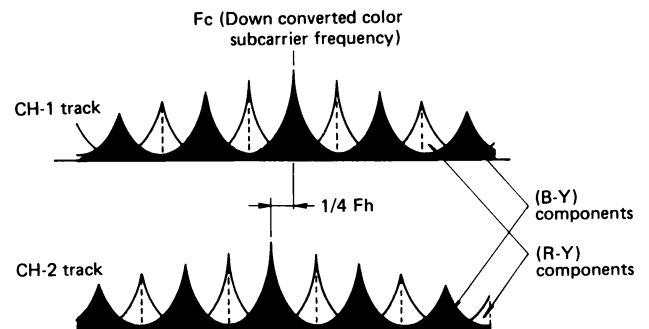


Fig. 1-12 Spectrum of down converted color signal

The FM luminance and down converted color signals are mixed to become the recording current. When recorded and played back using magnetic tape, which possesses 3-dimensional distortion and nonlinearity, interference in the form of $F_0 + 2F_{DC}$ (F_0 : FM carrier; F_{DC} : down converted color signal) becomes introduced and cannot be ignored. When the $2F_{DC}$ component is detected and demodulated, beat becomes produced with respect to the luminance signal and appears in the picture. Therefore, as with the color signal, F_c (down converted color subcarrier frequency) must be selected so that the $2F_{DC}$ component becomes 1/4 offset in relation to the luminance signal, i.e.:

$$2F_c = \frac{2n-1}{4} F_h$$

$$F_c = \frac{2n-1}{8} F_h = 321 F_h = 40 F_h + \frac{1}{8} F_h \quad (n = 161)$$

$$= 625 + 1.953 = 626.953 \text{ kHz}$$

When F_c is determined at $(40F_h + 1/8F_h)$, the spectrum of the CH-1 track B-Y component appears at $(nF_h + 1/8F_h)$ and the R-Y component at $(nF_h - 3/8F_h)$. In the CH-2 track distribution, B-Y appears at $(nF_h - 1/8F_h)$ and R-Y at $(nF_h - 5/8F_h)$.

Fig. 1-13 shows the $2F_{DC}$ component spectrum with respect to the playback luminance signal at this time.

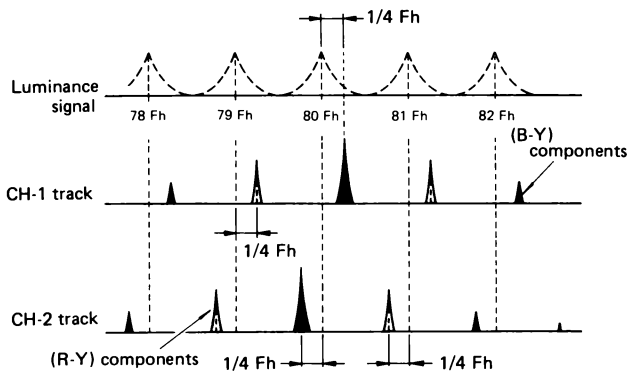


Fig. 1-13 $2F_{DC}$ playback spectrum

The $2F_{DC}$ components for both CH-1 and CH-2 become 1/4 line offset with respect to the luminance signal and thereby visually reduced. The 626.953 value was selected for both reducing noise and in consideration of color bandwidth.

1.5.3 Color Signal Recording Bandwidth

Response curves for the highpass and lowpass filters are indicated in Fig. 1-14.

Constant current characteristics are possessed by the down converted color signal recording current.

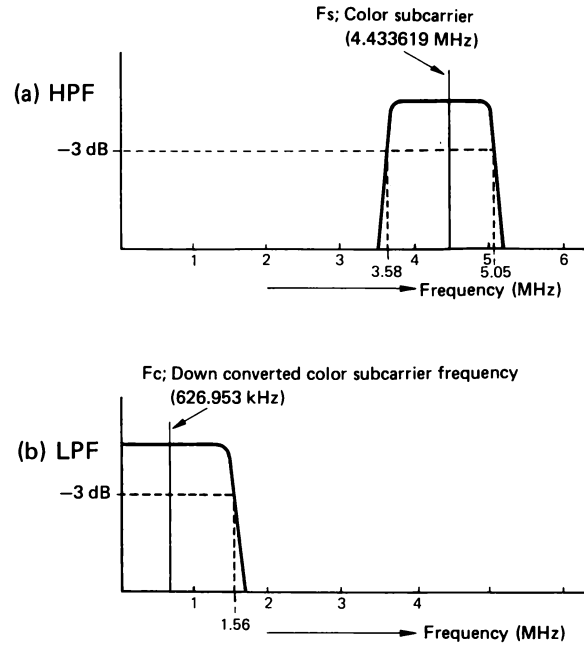


Fig. 1-14 Color signal recording bandwidth

1.6 COLOR SIGNAL PLAYBACK SYSTEM

The color signal playback system performs essentially the opposite function as the recording system. In addition, however, important corrections must be performed for color signal frequency and phase errors introduced by variations in tape speed and head rotation, and elasticity of the tape.

Fig. 1-15 indicates an abbreviated block diagram of this system.

Through a lowpass filter, the down converted color signal goes to the main converter. At this time, the down converted color subcarrier (F_C) contains an error component ($40F_h' + 1/8F_h' \pm \Delta f$) due to mechanical factors of the heads and tape. F_h' varies with the tape speed as $F_h \pm \Delta F_h$. Δf is the instantaneous error caused by head rotation irregularities and tape elongation and contraction.

Correction of the color time axis is performed using two types of data. These are 1) color burst signal phase and 2) horizontal sync signal frequency.

In the first loop, the burst component is separated from the color signal and compared with a reference frequency.

The second loop separates the horizontal sync signal from the video signal for comparison with the output of the 160 Fh VCO (voltage controlled oscillator).

The outputs of the above loops are mixed and control the 160 Fh VCO. The VCO output is counted down and applied to the phase shifter.

The phase shifter is controlled by the 25 Hz field pulse. Its output is the converter carrier ($F_s + 40 F_{h'} + 1/8 F_{h'} \pm \Delta f$), which includes the phase and frequency error component.

By frequency conversion with F_c , the color subcarrier frequency of 4.433619 MHz, which is free from frequency and phase deviations, becomes obtained through a bandpass filter. In the opposite manner as with recording, the phase shifter advances the CH-2 track phase 90° every line and $40 F_h'$ is supplied to the sub-converter. The playback color signal through the main converter and bandpass filter is applied to a 2 H delay line for removing crosstalk. Characteristics of the lowpass and bandpass filters are the same as those for recording (Fig. 1-15).

At the mixer, the playback color and luminance signals are mixed to become the video output signal.

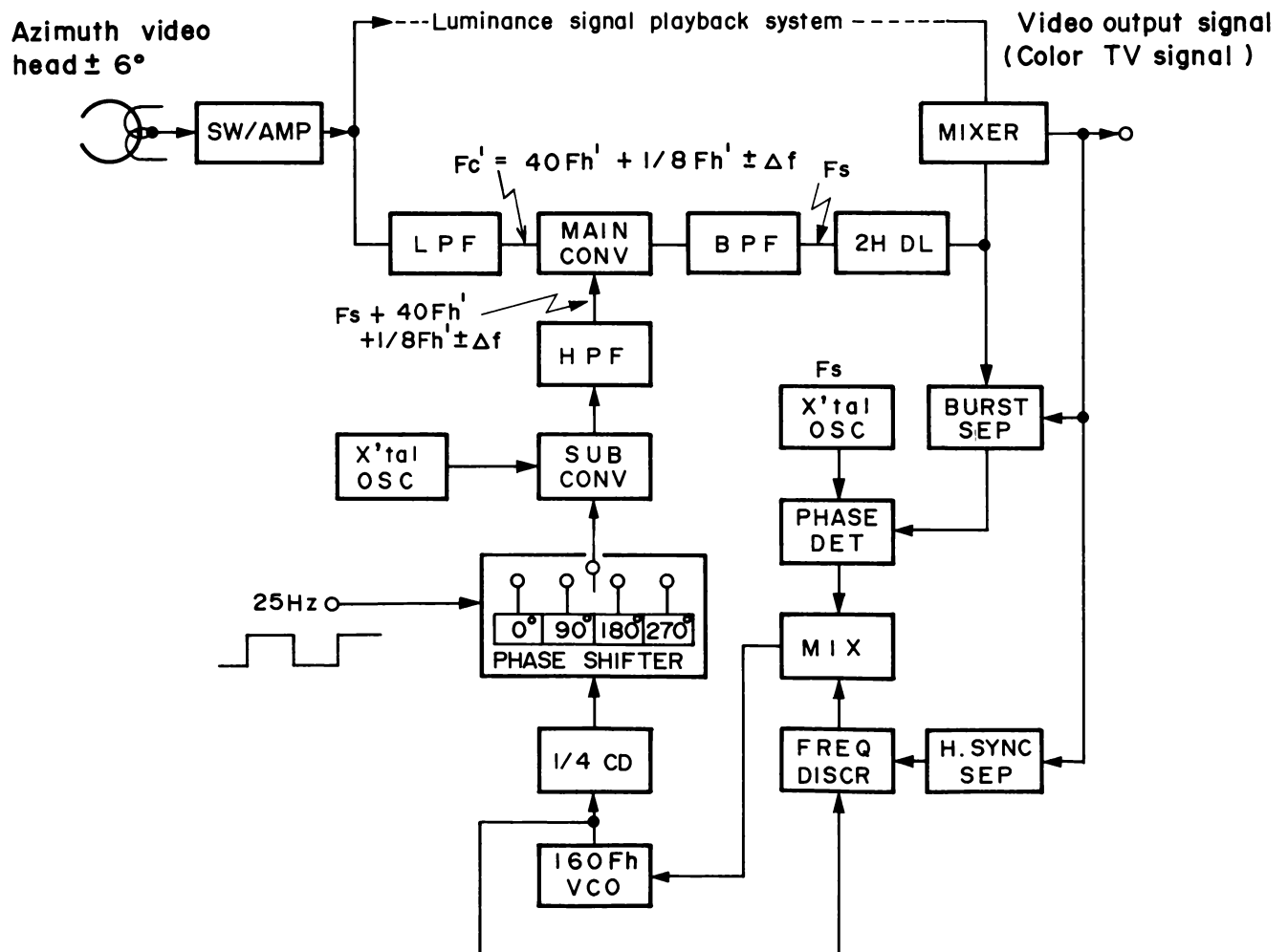


Fig. 1-15 Color signal playback system

1.7 CONTROL SIGNAL RECORDING SYSTEM

Control signal waveform, polarity and video head relationships are indicated in Fig. 1-16.

Phase of the control signal is the same as the vertical sync signal rise component of the CH-1 track. The positive pulse voltage is the reference 25 Hz.

The control signal is recorded on the control track above the saturation recording level.

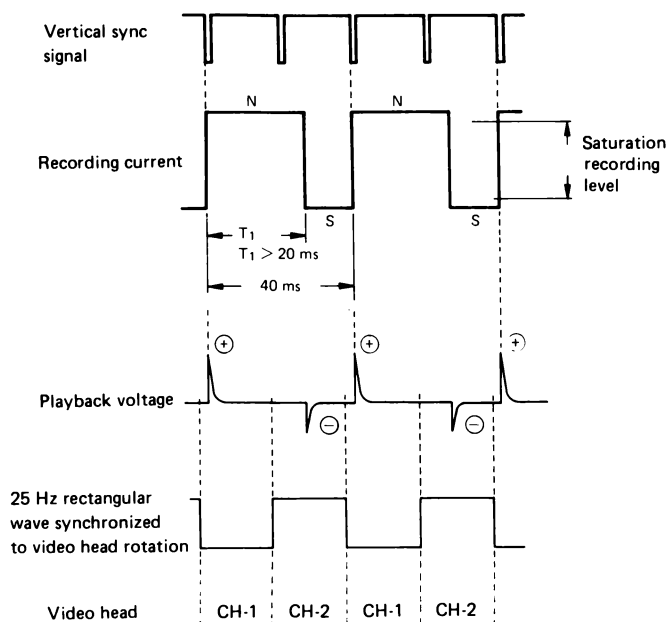


Fig. 1-16 Control signal

1.8 AUDIO SIGNAL RECORDING SYSTEM

1.8.1 Audio Signal Recording Level

Audio signal is recorded on the audio track to the defined level using an AC bias current recording system.

1.8.2 Audio Signal Recording Current Characteristics

The equalizing amplifier controls the recording current in order to obtain a flat frequency characteristic in the reproduced output. See Fig. 1-17.

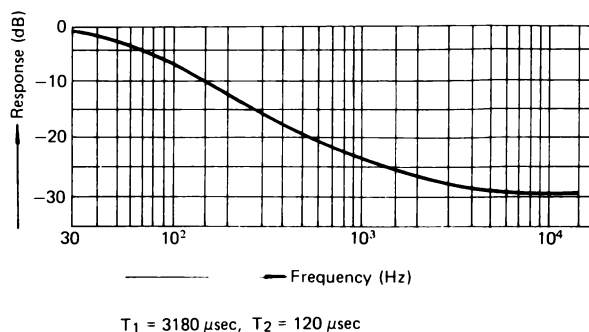


Fig. 1-17 Audio equalizing frequency characteristics

1.9 CASSETTE

1.9.1 Video Tape

Length : The relationship between tape length and time for recording and playback can be defined by the formula:

$$L = [1.42t + 2] \begin{smallmatrix} +3 \\ 0 \end{smallmatrix}$$

where, L : tape length (m)

t : recording or playback time (minutes)

Note: L shall be an integer obtained after all decimals produced in calculation are raised. (See "Reference Table".)

Width : 12.65 ± 0.01 mm

Fluctuation : less than 6 μ m

Thickness : $19 \begin{smallmatrix} +1 \\ -2 \end{smallmatrix} \mu$ m

Coercivity : 600 oersted class (nominal)

Optimum recording current shall not differ from the standard tape.

[Reference Table]

Kinds of Blank Cassettes

Kind of cassette	Recording or playback time	Length of video tape
E-240	240 min.	$344 \begin{smallmatrix} +2 \\ -1 \end{smallmatrix}$ m
E-180	180 min.	$258 \begin{smallmatrix} +3 \\ 0 \end{smallmatrix}$ m
E-150	150 min.	$215 \begin{smallmatrix} +3 \\ 0 \end{smallmatrix}$ m
E-120	120 min.	$173 \begin{smallmatrix} +3 \\ 0 \end{smallmatrix}$ m
E-90	90 min.	$130 \begin{smallmatrix} +3 \\ 0 \end{smallmatrix}$ m
E-60	60 min.	$88 \begin{smallmatrix} +3 \\ 0 \end{smallmatrix}$ m
E-30	30 min.	$45 \begin{smallmatrix} +3 \\ 0 \end{smallmatrix}$ m

1.9.2 Leader Tape and Trailer Tape

Length : In case time for recording or playback is:
over 90 minutes : 170 ± 20 mm
just or under

90 minutes : 150 ± 20 mm

Width : 12.65 ± 0.03 mm

Thickness : $40 \begin{smallmatrix} +5 \\ -25 \end{smallmatrix} \mu$ m

Material : Polyester film

Transparency : more than 50%.

Length of splicing: 12 ~ 19 mm

Gap of splicing : 0 ~ 70 μ m

Splicing force : more than 3 kg

1.9.3 Reel

Outside diameter : 89 ± 0.2 mm

Hub diameter : In case time for recording or playback is:
over 90 minutes : 26 ± 0.15 mm
just or under

90 minutes : 62 ± 0.2 mm

(If just or under 30 minutes, it can be 70 ± 0.2 mm.)

E-value : more than 1.5 mm

1.9.4 Simplified Illustrations

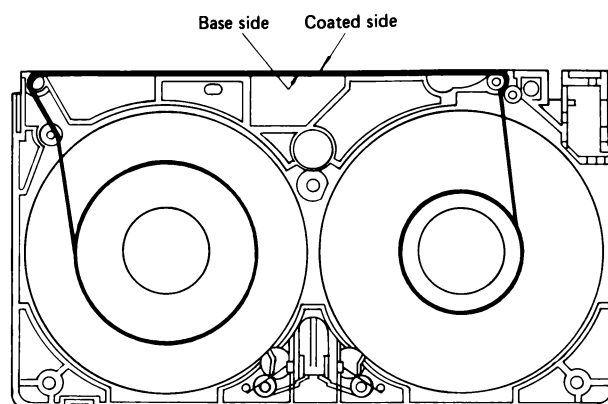


Fig. 1-18 Tape winding and tape path

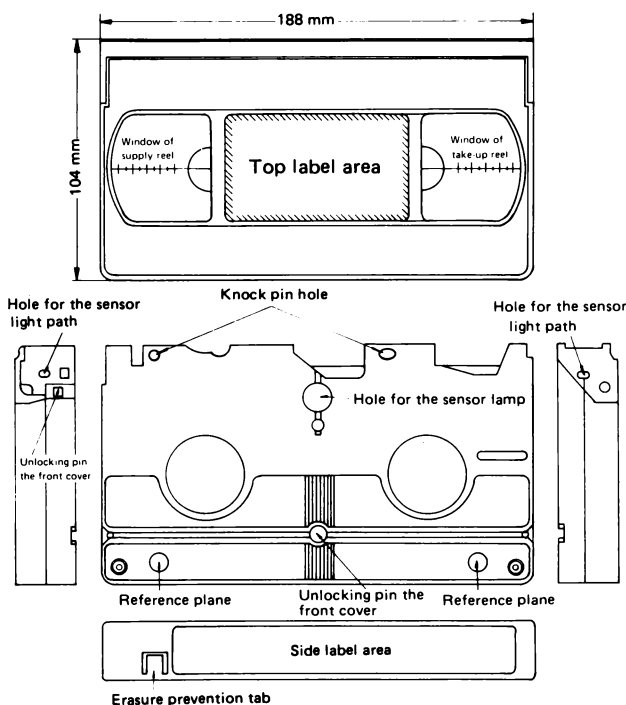


Fig. 1-19 Cassette appearance

SECTION 2 MECHANICAL ADJUSTMENT

2.1 GENERAL

2.1.1 Precautions

● **IMPORTANT**

1. Disconnect from power before removing or soldering components.
2. The tape transport mechanism has been precisely adjusted at the factory and ordinarily does not require re-adjustment.
3. Tighten the screws carefully to avoid damage to the chassis.
4. For service procedures that call for operation of the set without loading a tape around the head drum, disable the START and END sensors by applying opaque covers.

2.1.2 Required Test Equipment, Jigs and Tools

For proper mechanical adjustment, the following test equipment, jigs and tools are strongly recommended. Without them, a long trial-and-error period would be necessary, resulting in possible damage. In addition, general-purpose tools and a metric hex key (obtain locally) are required.

1. Test equipment required:

Color television or monitor

Oscilloscope (wide-band, dual trace, triggered, delayed sweep)

Recording tape

Alignment tapes & selfrecording tapes

Cord Color	Connection
SKY BLUE	MULTI CONNECTOR – 0 2 CN12
GREEN	MULTI CONNECTOR – 0 2 CN11
RED	0 3 CN3 – A/C HEAD
BLACK	0 9 CN1 – 0 2 CN7
YELLOW	0 6 CN1 – 0 2 CN6
WHITE	0 3 CN6 – 0 4 CN1
PINK	0 3 CN2 – 0 2 CN9
BROWN	0 3 CN1 – 0 2 CN8
ORANGE	0 1 CN4 – 0 2 CN14
BLUE	0 1 CN3 – 0 2 CN3
VIOLET	0 1 CN2 – 0 2 CN2
GRAY	0 1 CN1 – 0 2 CN1

Table 2-2 Patch cord connection

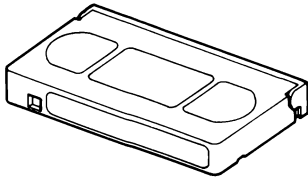
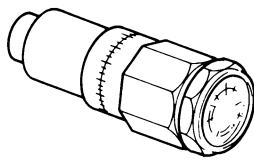
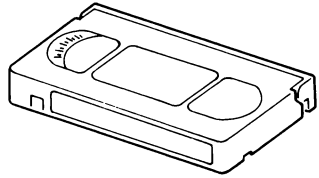
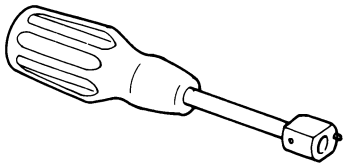
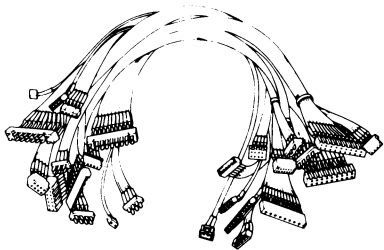
Alignment tapes (Self Recording tapes E-180) MH-2 	Torque gauge assembly PUJ48075-2 	Back tension cassette gauge PUJ48076 
A/C head position tool PUJ47351-2 	Patch cord PUJ36857 	

Table 2-1 Jigs and tools

2.1.3 Disassembly

1. Out side covers

– DISASSEMBLY PROCEDURE REMVOING ORDER –

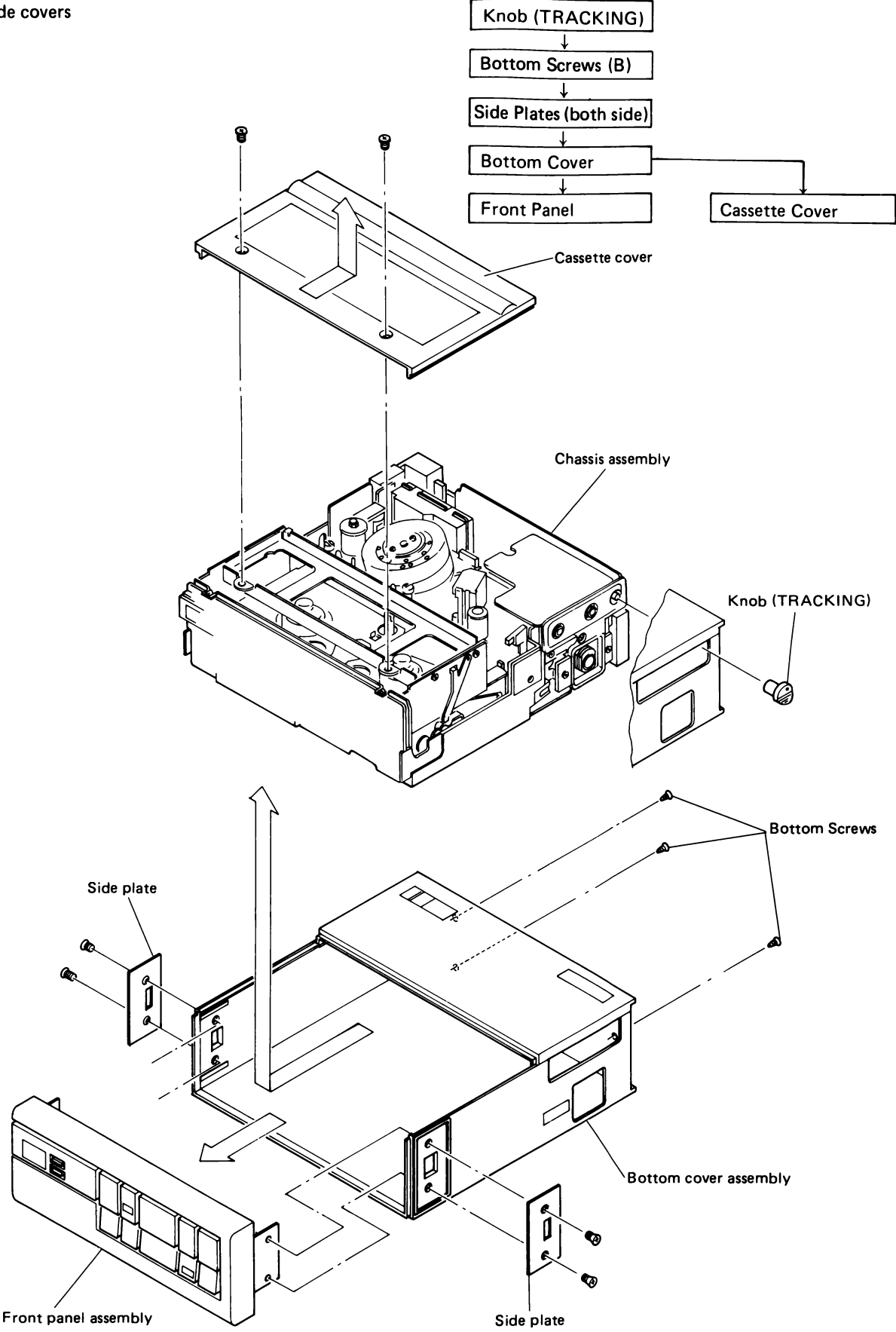


Fig. 2-1 External covers

2. Main circuit boards

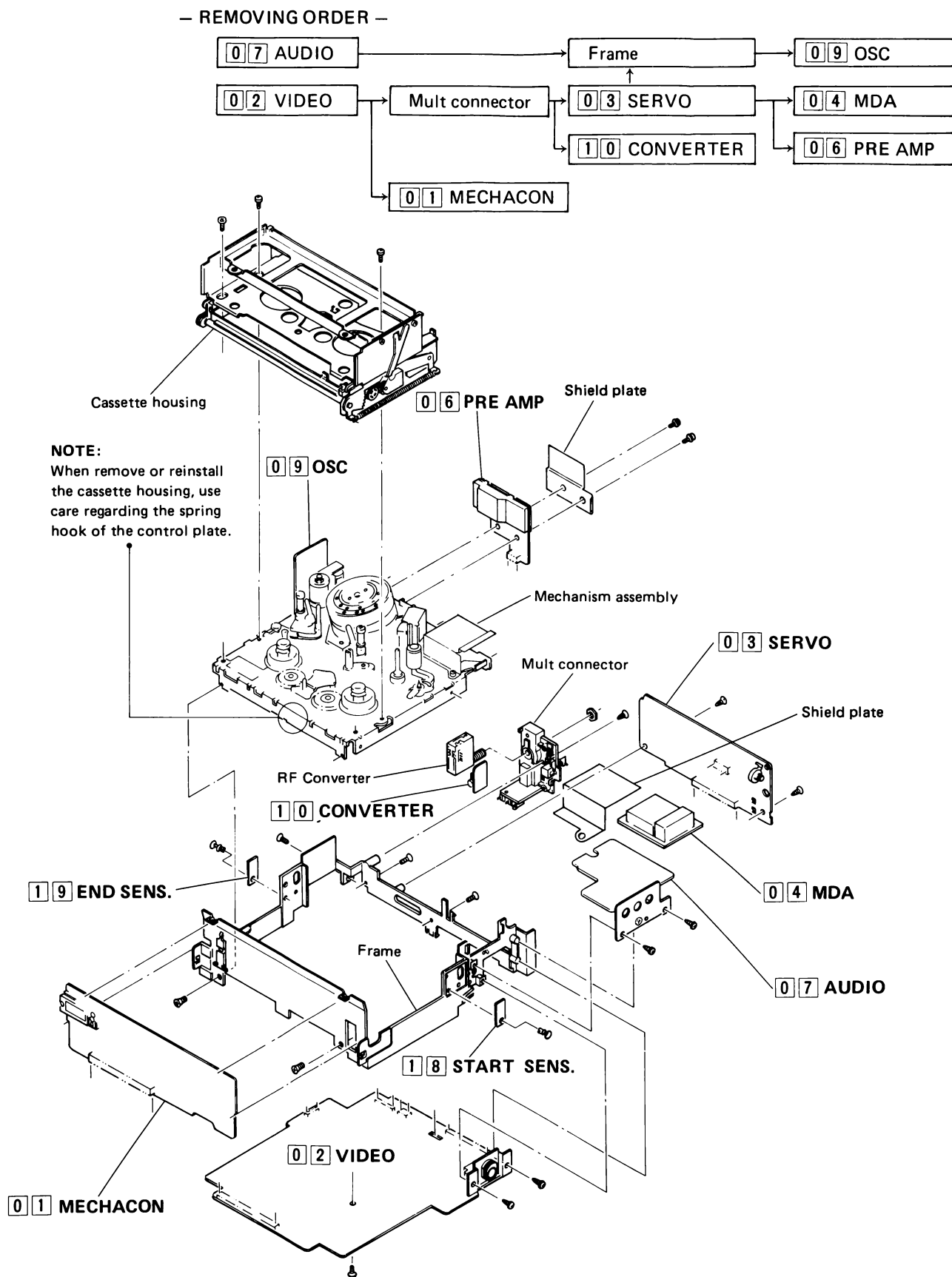


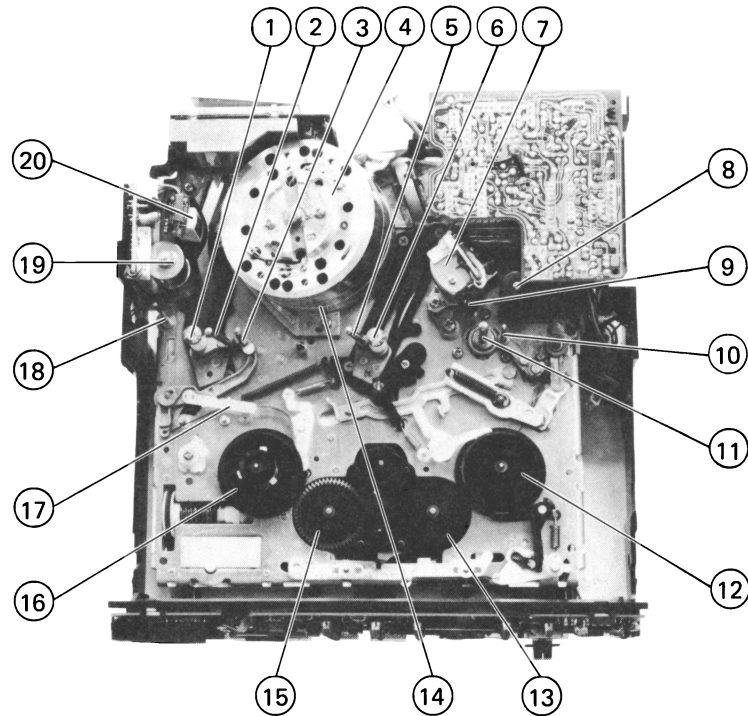
Fig. 2-2 Main circuit boards

2.2 PERIODIC MAINTENANCE

The following procedures are recommended for maintaining optimum performance and reliability of this video cassette recorder.

2.2.1 Layout of Maintenance Parts

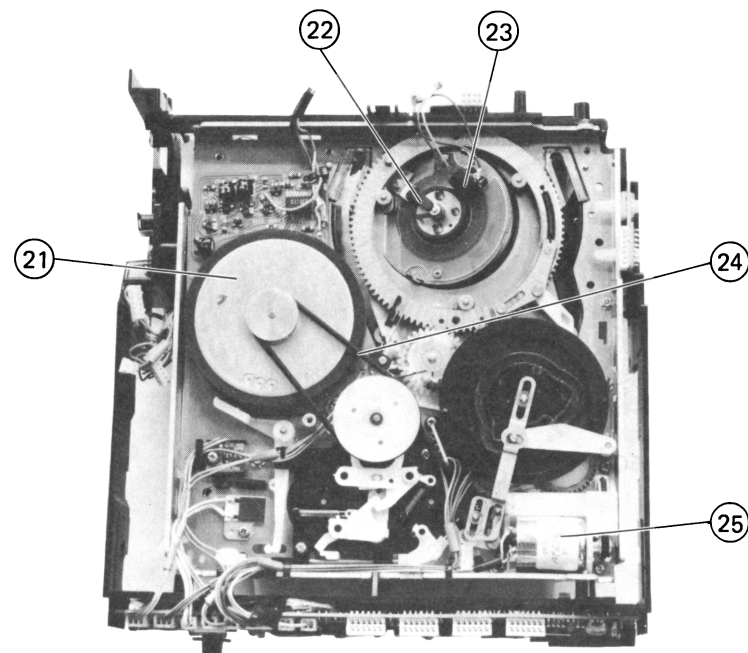
1. Top view



- 1. SUP guide roller
- 2. SUP slant pole
- 3. Tension pole
- 4. Upper drum
- 5. TU slant pole
- 6. TU guide roller
- 7. Audio/Control head
- 8. Pinch roller
- 9. TU guide pole
- 10. TU guide pin
- 11. Capstan
- 12. TU reel disk
- 13. TU clutch
- 14. Lower drum
- 15. SUP clutch
- 16. SUP reel disk
- 17. Tension band
- 18. SUP guide pin
- 19. Impedance roller
- 20. Full erase head

Fig. 2-3 Top view

2. Bottom view



- 21. Capstan motor
- 22. Brush
- 23. Pick-up head
- 24. Reel belt
- 25. Mode control motor

Fig. 2-4 Bottom view

2.2.2 Service Schedule for Main Components

The following table lists the parts which should receive periodic servicing at the recommended intervals.

	Part Name	Replacement Part No.	Periodic Service Schedule (Operating Hours)										Reference Section	Remarks
			500	1000	1500	2000	2500	3000	3500	4000	4500	5000		
Tape transport system	Tension pole													- For cleaning, use a lint-free cloth or gauze dampened with alcohol. - After cleaning with alcohol, allow the parts to dry thoroughly before using a cassette tape.
	SUP slant pole													
	SUP guide roller													
	SUP guide pin													
	Impedance roller													
	TU guide pole		☆	☆	☆	☆	☆	☆	☆	☆	☆	☆		
	Capstan													
	TU guide pin													
	TU guide roller													
	TU slant pole													
Drive system	Lower drum													2.3.1 —When cleaning the head tips on the upper drum, do not clean them with a vertical stroke. Use only a gentle back and forth motion in the direction of the tape path. 2.3.2 —Do not over lubricate. 2.3.3 —Torque check (Refer to section 2.4.3.) 2.3.4 —Back tension check (Refer to section 2.4.4.)
	Upper drum		☆	○	●	☆	○	●	☆	○	●	☆	2.3.1	
	Full erase head		☆	☆	☆	☆	☆	☆	☆	☆	☆	○	2.3.2	
	Audio/control head		☆	☆	☆	☆	☆	●	☆	☆	☆	☆	2.3.3	
	Pinch roller		☆	☆	☆	☆	☆	●	☆	☆	☆	☆	2.3.4	
	Capstan motor											○	2.3.5	
	Reel belt					●				●				
	Motor bracket (Mode control motor) (Belt)											○	2.3.6	
	SUP reel disk					△				△		○	2.3.7	
	TU reel disk													
Others	TU clutch			○		○		○		○		○	2.3.8	2.3.9 —Torque check (Refer to section 2.4.3.) 2.3.10 —Back tension check (Refer to section 2.4.4.)
	SUP clutch													
	Brush		☆	☆	☆	☆	☆	☆	☆	☆	☆	○	2.3.9	
	Tension band			○		○		○		○		○	2.3.10	

☆ Cleaning ● Replacement △ Lubrication ○ Check and Replace if necessary.

Table 2-3 Standard service periods

Above replacement times will vary greatly according to environmental and usage conditions. Routine inspection and maintenance are also important factors that influence the unit life. Note that rubber parts may become aged or deformed after long periods of storage, even if the unit is not used.

Note: Even if the unit is not used frequently, cleaning, lubrication and replacement of the belts should be undertaken every 2 years.

2.3 MAIN ASSEMBLY REPLACEMENT

Remove the external covers, circuit boards and cassette housing, as necessary, to allow replacement.

2.3.1 Upper Drum (See Figure 2-5.)

- 1. Unsolder four wires connecting the lower drum from the relay pins of the upper drum (perform quickly to avoid damaging the wires).

Relay Pin Color	Channel	Inner/Outer
Brown	CH-1	Brown/Gray
Red	CH-2	Red/White

Table 2-4 Upper drum wiring

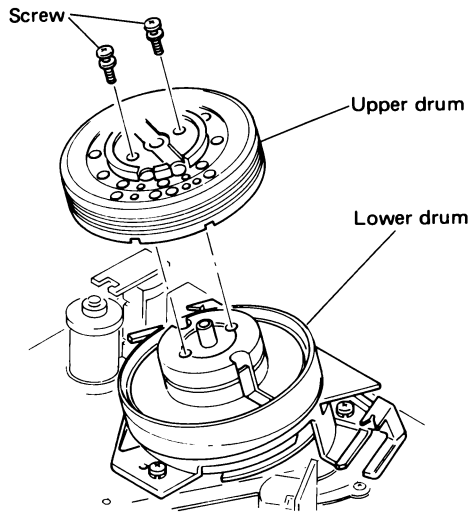


Fig. 2-5 Upper drum replacement

- 2. Take out two screws and remove the upper drum by lifting it upwards.
- 3. Use alcohol to clean the lower face of new upper drum and the upper face of the lower drum.
When handling and installing the new upper drum, avoid directly touching the head tips and use care not to scratch the drum.
- 4. Reassemble by reversing the above steps. When resoldering, observe the correct channels (refer to Table 2-4) and avoid overheating the wires.
- 5. Perform the upper drum eccentricity adjustment.
 - 1) Connect an oscilloscope to TP-PB. FM (FM OUT) of the SERVO board. Trigger the oscilloscope externally with the signal from TP-11 (DRUM F.F.) of the SERVO board.
 - 2) Supply a video signal, then playback.
 - 3) Observe the FM waveform, confirm that the FM waveform becomes flat. If the waveform becomes as shown in Figure 2-6, reinstallation of the upper drum is required.



Fig. 2-6 Incorrect example

- 6. Perform the FM waveform checks and adjustments (refer to section 2.4.6).
- 7. Perform the P.B./REC switching point adjustments. Refer to sections 3.5.5, 3.5.6 and 3.5.9.

2.3.2 Full Erase Head (See Figure 2-7.)

- 1. Take out the nut and remove the flanges, washers, impedance roller, collar and spring.
- 2. Disconnect connector CN2 from the OSC board.
- 3. Unhook the torsion spring from the F.E. head and remove the F.E. head upwards.
- 4. Install a new F.E. head and reassemble the other parts into their original positions.
- 5. Perform the impedance roller height/FM waveform checks and adjustments (refer to sections 2.4.5 and 2.4.6).

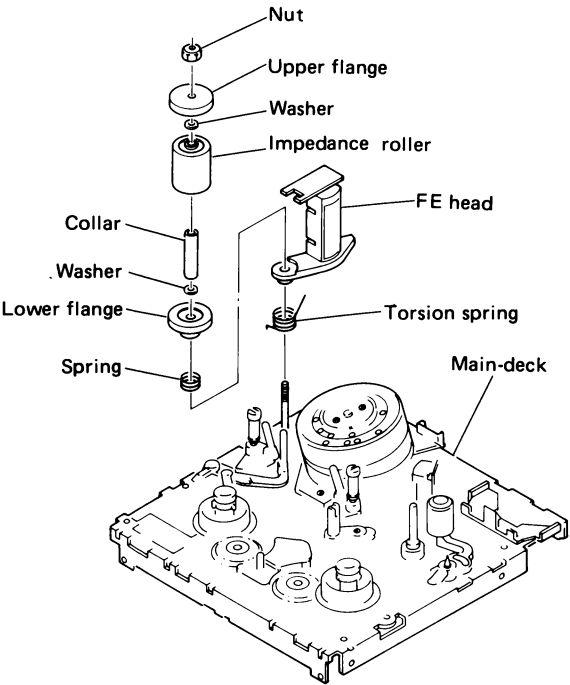


Fig. 2-7 F.E. head replacement

2.3.3 Audio/Control Head (See Figure 2-8.)

- 1. Take out the screw and remove the shield cover.
- 2. Disconnect two connectors CN4 and CN5 from the AUDIO board, disconnect connector CN3 from the SERVO board.
- 3. Take out two screws and remove the A/C head.
- 4. Replace the A/C head and reassemble by reversing the above steps.

5. Perform the A/C head inclination/interchangeability checks and adjustments (refer to sections 2.4.5 and 2.4.6).
6. Install the shield cover into its original position.

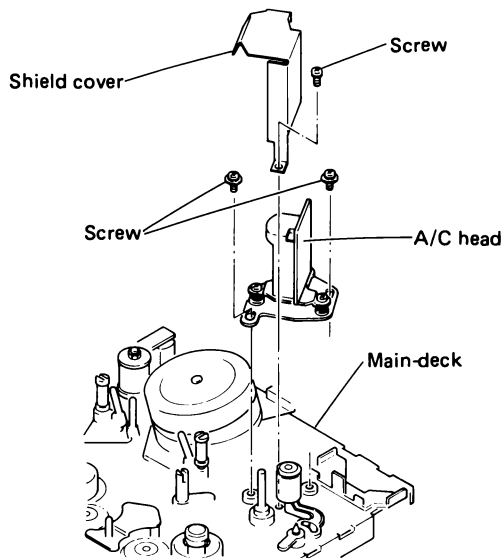


Fig. 2-8 A/C head replacement

2.3.4 Pinch Roller (See Figure 2-9.)

1. Take out the screw, and remove the pinch roller, collar and PR cap.
2. Replace the pinch roller and reassemble by reversing the above steps.

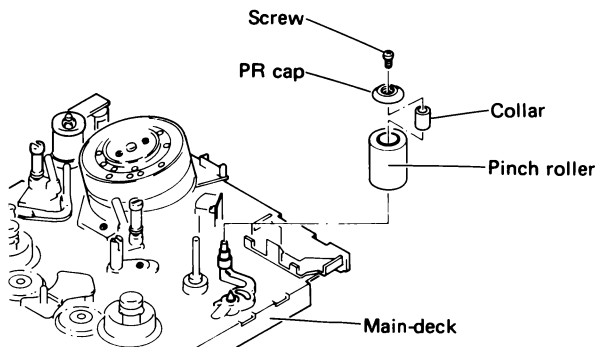


Fig. 2-9 Pinch roller replacement

2.3.5 Capstan Motor (See Figure 2-10.)

1. Disengage the reel belt from the capstan motor, and disconnect connector CN4 from the SERVO board.
2. Take out three screws and remove the capstan motor downwards. Use care regarding the capstan brake when removing the capstan motor.
3. Replace the capstan motor and reassemble by reversing the above steps.
4. Perform the capstan DISCR. position adjustments. Refer to sections 3.5.2.

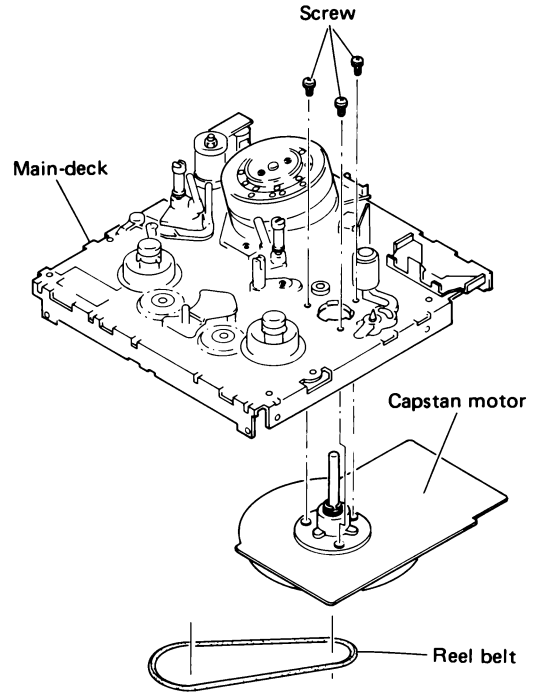


Fig. 2-10 Capstan motor replacement

2.3.6 Mode Control Motor (See Figure 2-11.)

1. Disconnect connector CN10 from the MECHACON board.
2. Take out three screws to remove the motor with bracket.
3. Replace the motor bracket and reassemble by reversing the above steps.

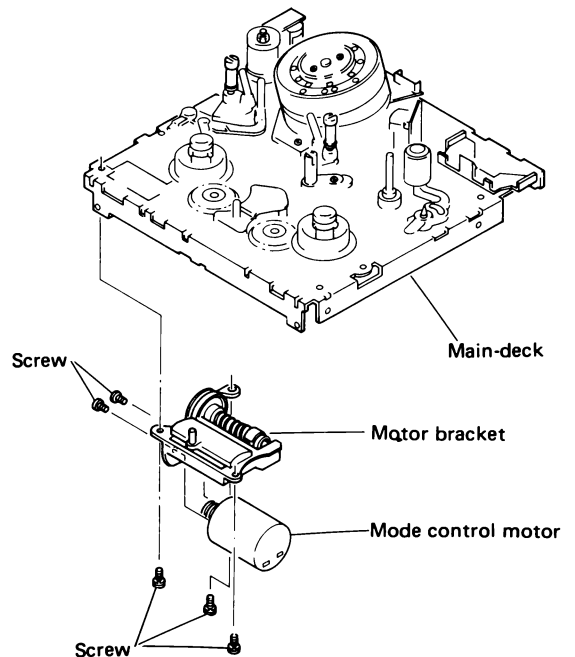


Fig. 2-11 Mode control motor replacement

When replacing only the mode control motor, perform the following steps.

4. After removing the motor bracket, unsolder two wires and a capacitor from the mode control motor.
5. Disengage a belt from the motor pulley, take out two screws and remove the mode control motor.
6. Replace the mode control motor and reassemble by reversing the above steps. Use care regarding the motor wire polarity (refer to Table 2-5).

Motor Polarity	Wire Color
+	Red
-	Brown

Table 2-5 Motor wiring

2.3.7 Reel Disks (See Figure 2-12.)

- Supply reel disk
 1. Disengage the tension band from the tension pole and move it to the side. Use care regarding the FF brake when moving the tension band.
 2. Take out the slit washer, move the FF brake and remove the supply reel disk by lifting it upwards. Use care regarding the washer under the reel disk.
 3. After cleaning the reel shaft with alcohol, lubricate it with sewing machine oil. Do not over lubricate.
 4. Replace the supply reel disk and reassemble by reversing the above steps.
 5. Perform the back tension check (refer to section 2.4.4).

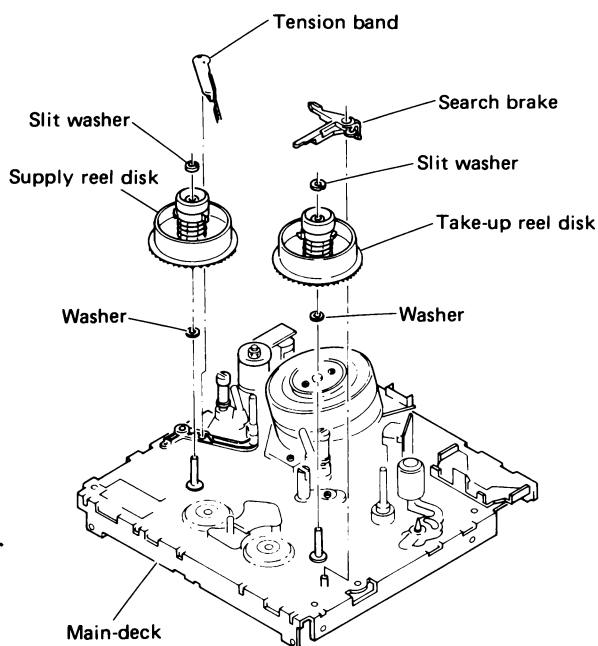


Fig. 2-12 Supply and Take-up reel disk replacement

- Take-up reel disk
 1. Disengage the spring and remove the search brake by lifting it upwards.
 2. Take out the slit washer, move the REW brake and remove the take-up reel disk by lifting it upwards. Use care regarding the washer under the reel disk.
 3. After cleaning the reel shaft with alcohol, lubricate with sewing machine oil. Do not over lubricate.
 4. Replace the take-up reel disk and reassemble by reversing the above steps.

2.3.8 Clutches (See Figure 2-13.)

- Take-up clutch
 1. Remove the take-up reel disk (refer to section 2.3.7).
 2. Take out the slit washer and remove the take-up clutch by lifting it upwards. Use care regarding the washer under the clutch.
 3. Replace the take-up clutch and reassemble by reversing the above steps.
 4. Perform the take-up torque check (refer to section 2.4.3).
- Supply clutch
 1. Remove the supply reel disk (refer to section 2.3.7).
 2. Take out the slit washer and remove the supply clutch by lifting it upwards. Use care regarding the washer under the clutch.
 3. Replace the supply clutch and reassemble by reversing the above steps.

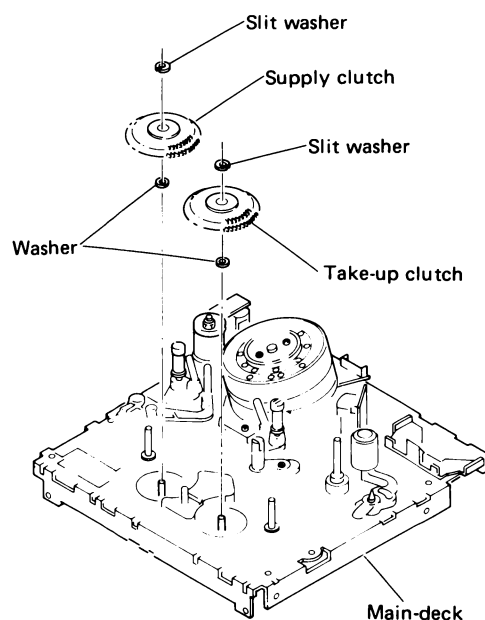


Fig. 2-13 Take-up and Supply clutch replacement

2.3.9 Brush (See Figure 2-14.)

1. Take out the screw and remove the brush, and clean the commutator with alcohol.
2. Replace and install the brush as before, check that the brush contacts the center of the commutator.

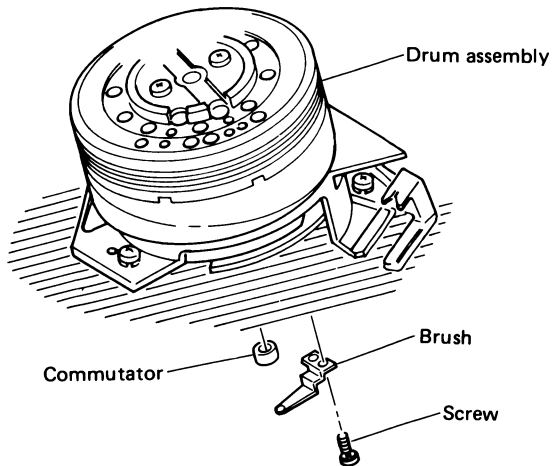


Fig. 2-14 Brush replacement

2.3.10 Tension Band (See Figure 2-15.)

1. Take out the screw and disengage the tension band from the tension pole.
2. Move the FF brake and remove the tension band.
3. Replace and install the tension band as before.
4. Perform the tension pole position check and the back tension check (refer to sections 2.4.2 and 2.4.4).

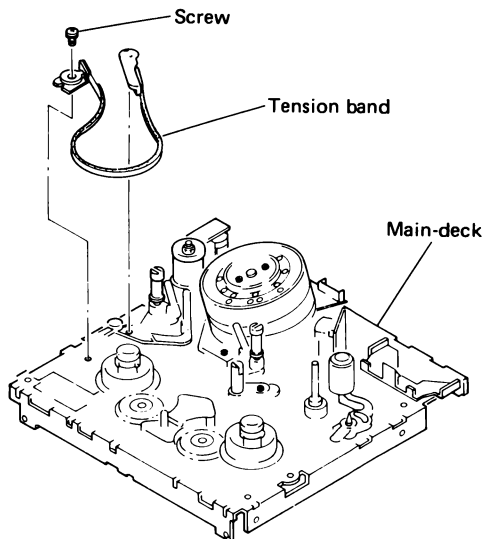


Fig. 2-15 Tension band replacement

2.3.11 Pick-up Head (See Figure 2-16.)

1. Disconnect connector CN5 from the SERVO board.
2. Take out the screw and remove the pick-up head.
3. Replace the pick-up head and reassemble by reversing the above steps, check that the pick-up head is toward the center portion of the drum shaft.
4. Perform the drum pulse level adjustment and PB/REC switching point adjustments. Refer to sections 3.5.4, 3.5.5, and 3.5.1.

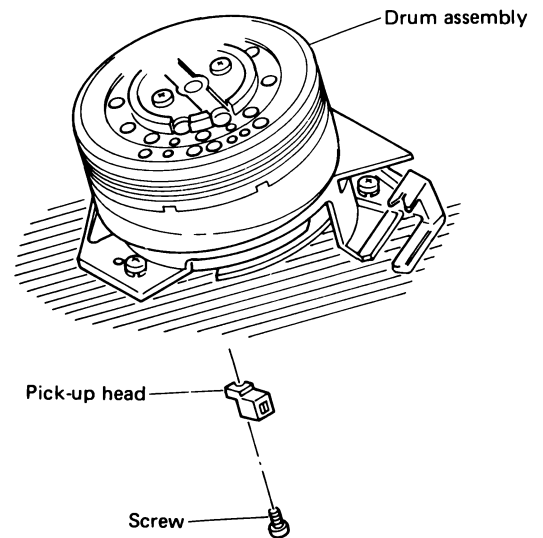


Fig. 2-16 Pick-up head replacement

2.4 CHECKS AND ADJUSTMENTS

2.4.1 Loading System Timing Check

1. When the STOP arrow mark of the control cam is aligned with the center of the loading gear, confirm that the boss of the loading gear (1) corresponds with hole A of the supply loading ring.
2. At the same time, confirm that the two holes of the supply and take-up loading rings are aligned through the hole of the main-deck (arrow B in figure 2-17).
3. If a discrepancy is noted, after removing the control cam, remove and reinstall the loading gears and connect gear (2) to obtain the correct position.
4. In order to remove and install the control cam, put suitable tools (hex key wrench, screw driver, etc.) through the holes (arrow B and arrow C in figure 2-17).
5. When install the control cam, move the rod (1) fully to the arrow direction in figure 2-17, then mount the control cam with the mode sensor assembly in the state that the biggest arrow mark on the control cam is aligned with the center of the loading gears.

In this state, the cassette housing pops up.

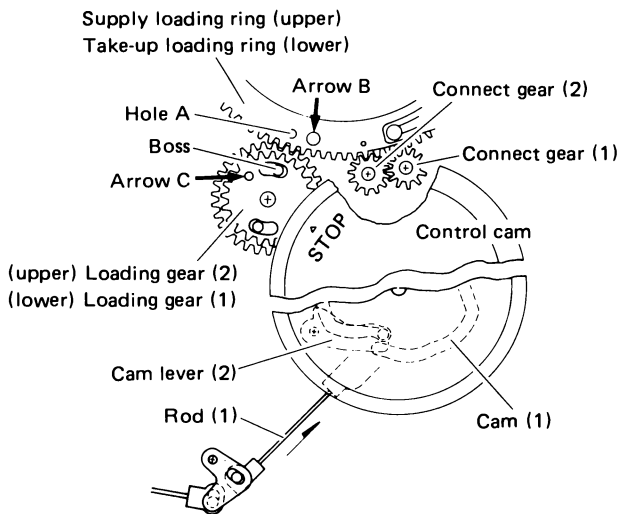


Fig. 2-17 Loading system timing check

2.4.2 Tension Pole Position Check

1. Without loading a tape, set for the PLAY mode.

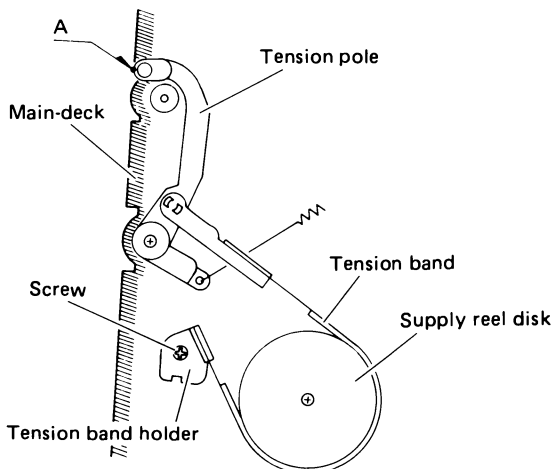


Fig. 2-18 Tension pole position check

2. Confirm that the left edge of the tension pole (section A in figure 2-19) lies upon the side edge of the main-deck.
3. If necessary, loosen the screw and adjust the tension band holder to obtain the correct tension pole position.

2.4.3 Take-up Torque Check

1. Set the PLAY mode without the cassette housing.
2. Set the torque gauge on the take-up reel disk.
3. Relax the grip on the torque gauge so that the indicator needle and scale rotate at an equal speed, then read the indication. The correct value is between 60 and 100.
4. If not the correct value, install a new take-up clutch. In addition to replacing the supply clutch should also be replaced. Refer to section 2.3.8.

2.4.4 Back Tension Check

1. Use the back tension cassette gauge and set for the PLAY mode.
2. Confirm that the indication is between 14 and 22.
3. If not the correct value, after checking the tension pole position, replace the tension band. If the indication fluctuates greatly, replace the supply reel disk. Refer to sections 2.3.10 and 2.3.7.

2.4.5 Tape Transport System Checks and Adjustments

The tape transport system has been precisely aligned at the factory and normally does not require readjustment. The following check is therefore necessary only in cases of severe usage or when replacing parts affecting the tape transport system.

● Tape transport checks

1. Use a 180-minute tape and check at tape beginning and ending portions according to the following steps.
 - 1) During PLAY mode, observe tape at the entrance and exit portions of the drum lead (refer to Figures 2-19 and 2-20).
Confirm that the tape slips neither upward nor downward with respect to the lead.

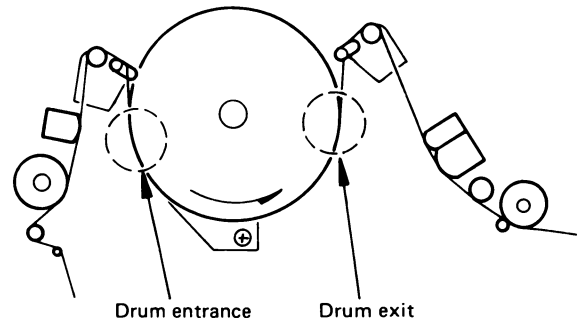


Fig. 2-19 Drum entrance/exit

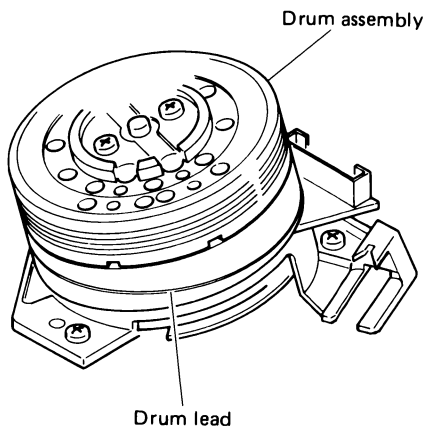


Fig. 2-20 Drum lead

- 2) If defects are noted during the above check, perform the guide roller height adjustment.
- 3) During PLAY mode, observe the tape at the take-up guide pole and impedance roller. Confirm absence of curling, wrinkling, etc.

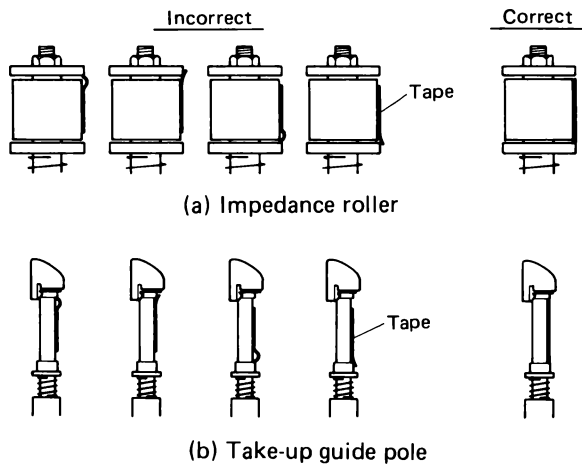


Fig. 2-21 Impedance roller/guide pole

- 4) If defects are noted during the above check, perform the impedance roller height and the A/C head inclination adjustments.
2. At the ending portion of the recorded 180-minute tape, set for the PB REV mode.
 - 1) Confirm absence of curling, wrinkling, slip, etc. at the take-up guide pole.
 - 2) In the same manner, during Search REV mode, check at the take-up guide pole.
 - 3) If defects are noted during the above check, perform the reverse tape path adjustment.
3. Perform the interchangeability checks and adjustment (refer to section 2.4.6).
- Guide roller height adjustment
 1. Slightly loosen setscrew under the guide roller of the pole base.
 2. Use a cassette tape and set for the PLAY mode.

3. With a slotted screwdriver, slightly turn the guide roller so that the tape travels smoothly in the drum lead without slipping upwards or downwards.

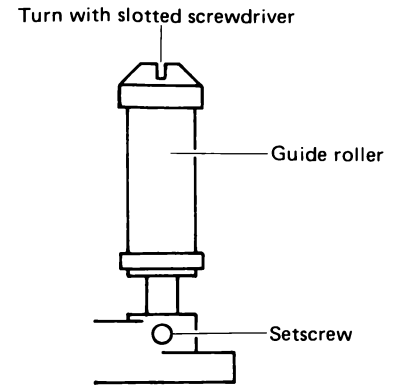


Fig. 2-22 Guide roller height adjustment

Notes:

- 1) Loosen the setscrew only enough to allow the guide roller to be turned.
If excessively loose, tape motion may turn the roller inadvertently.
- 2) Turn the roller carefully to avoid damage to the tape.

● Impedance roller height adjustment

1. Use a cassette tape and set for the PLAY mode.
2. Use a metric nutdriver for turning the nut to align the tape lower edge with the upper face of the lower flange.

● A/C head inclination adjustment

1. Use a cassette tape and set for the PLAY mode.
2. Turn A/C head screw A and align the tape lower edge with the upper face of the lower guide flange.

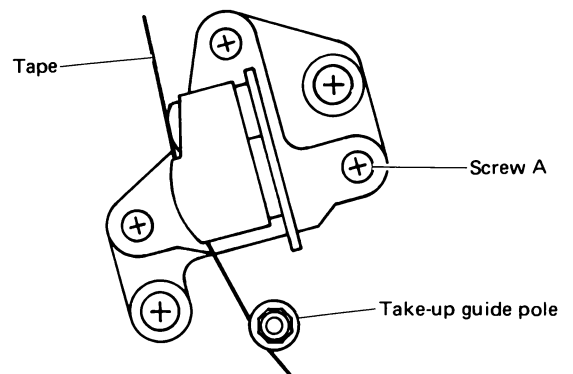


Fig. 2-23 A/C head inclination adjustment

Note: Do not adjust the height of the take-up guide pole itself.

● Reverse tape path adjustment

1. At the ending portion of the recorded 180-minute tape, set for the Search REV mode.
2. Adjust the setscrew of the TU guide for smooth tape transport at the take-up guide pole.

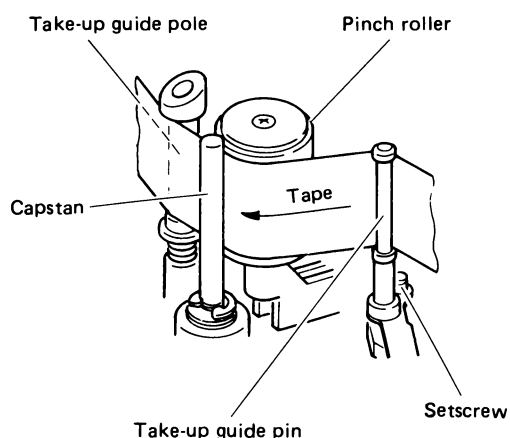


Fig. 2-24 REV tape path adjustment

Note: Two or three seconds may elapse after adjusting the setscrew for the effect to appear at the take-up guide pole.

3. Set for the PB REV mode and confirm absence of curling, wrinkling, etc.
4. If defects are noted, repeat the above steps 1 and 2.

2.4.6 Interchangeability Checks and Adjustments

Before using the alignment tape, use a regular tape and confirm correct tape transport operation.

• FM waveform checks and adjustments

1. Connect an oscilloscope to TP-PB. FM (FM OUT) of the SERVO board. Trigger the oscilloscope externally with the signal from TP-11 (DRUM F.F.) of the SERVO board.
2. Play the stairstep signal of alignment tape MH-2.

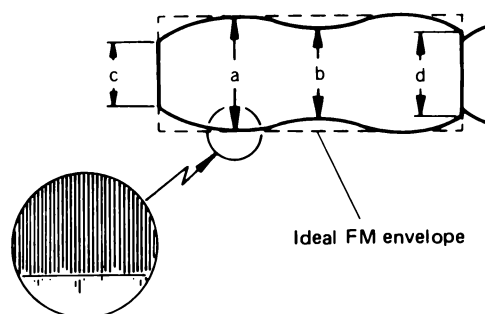


Fig. 2-25 FM waveform (maximum output)

- 1) Turn the TRACKING knob to obtain the maximum FM output. Refer to Fig. 2-25. Observe the FM waveform, read the maximum level (a) and the minimum levels (b), (c) and (d). Confirm that:

$$\frac{b}{a} \geq 0.7, \frac{c}{a} \geq 0.5, \text{ and } \frac{d}{a} \geq 0.5$$

Note: If the waveform is serrated, read the value at the most uniform serrations.

- 2) Turn the TRACKING knob to vary the FM output from maximum to minimum. Confirm that the waveform variation is nearly parallel.

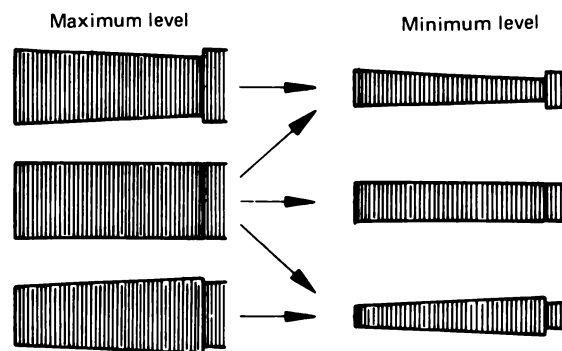


Fig. 2-26 Normal waveform examples

- 3) If the above checks yields normal results, proceed to the A/C head adjustments.

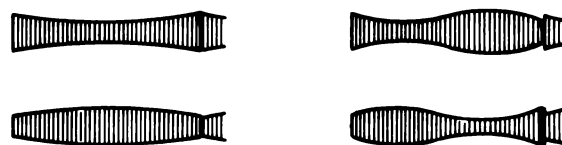


Fig. 2-27 Incorrect waveform examples

- 4) If defects are noted, perform the following adjustments.
3. Loosen the setscrews of the supply and take-up guide rollers. If the guide rollers turn freely, slightly tighten the setscrews.
4. Play the stairstep signal of alignment tape MH-2.
5. Observe oscilloscope display and adjust the TRACKING knob for maximum FM output.

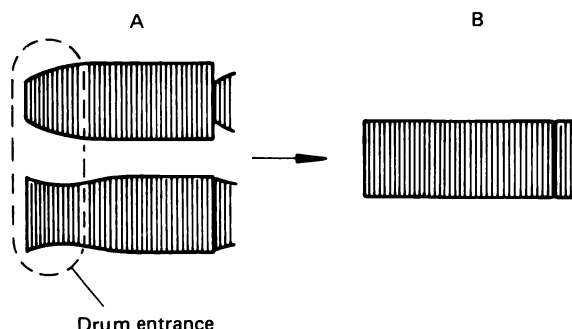


Fig. 2-28 Drum entrance adjustment

- 1) Refer to Fig. 2-28. Examples of incorrect waveforms are shown by A. Use a slotted screwdriver to adjust the supply guide roller so that the rising portion (drum entrance) of the waveform becomes flat as shown by B.

- 2) In the same manner as for the drum entrance, turn the take-up guide roller to adjust the falling portion (drum exit) of the FM waveform. Incorrect examples are shown by C in Fig. 2-29, while D indicates the correct adjustment.

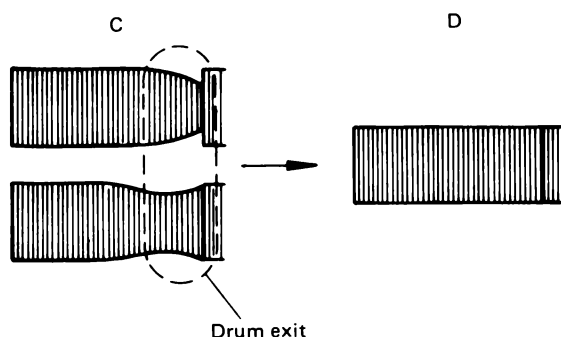


Fig. 2-29 Drum exit adjustment

- 3) In addition to observing the waveform, confirm absence of tape slippage or curling at the impedance roller and take-up guide pole.
- If the tape separates from the guide or wrinkling occurs at the impedance roller, adjust the impedance roller height (refer to section 2.4.5).
- If at the take-up guide pole, adjust by turning A/C head screw A (refer to section 2.4.5).
6. Observe the FM waveform and adjust the TRACKING knob for minimum FM output level.
- 1) If the waveform becomes similar to A, B, C or D in Fig. 2-30, carefully adjust the supply and take-up guide rollers so that the waveform becomes similar to E, F or G.

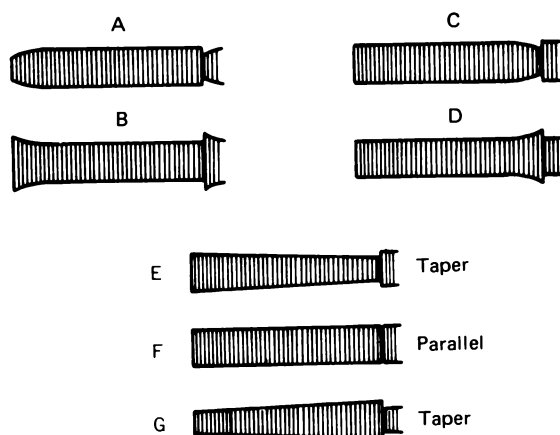


Fig. 2-30 Minimum FM waveform

Note: At this time, if the waveform fluctuates, adjust for minimum fluctuation.

- 2) Vary the FM output level and perform fine adjustment of the supply and take-up guide rollers.

- A/C head height and azimuth adjustments (See Figure 2-31.)

Incorrect A/C head height can impair audio signal-to-noise ratio when playing back a pre-recorded tape.

1. Connect an oscilloscope to CN2-2 (AUDIO OUT) of the AUDIO board.
2. Play 6 kHz segment (stairstep signal) of the alignment tape MH-2.

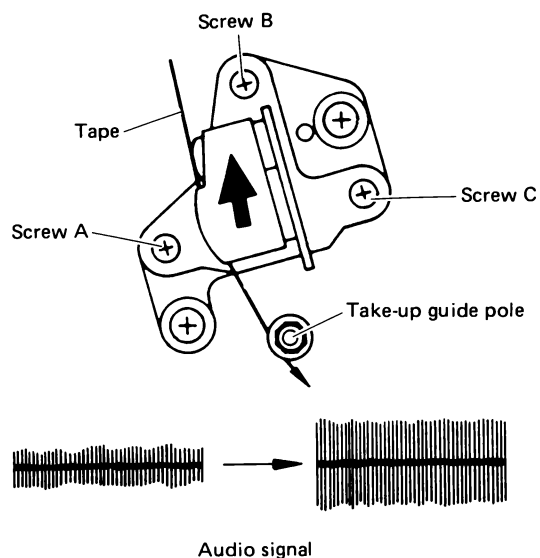


Fig. 2-31 A/C head adjustments

- 1) Turn screws A, B and C in succession by small and equal increments at a time and adjust for maximum audio output level. With reference to screw A, adjust azimuth with screw B and screw C so that small tape wrinkles are not produced at the guide pole, but at the same time, audio output becomes maximum and level fluctuations minimum.

- Setscrew tightening

1. After confirming absence of tape wrinkling and other transport irregularities, tighten the setscrews in the STOP mode.

Note: Since the guide rollers are easily moved, use care when tightening.

2. Again perform the FM waveform checks.

- Control head phase adjustment (See Figure 2-32.)

1. Connect an oscilloscope to TP-PB. FM (FM OUT) of the SERVO board. Trigger the oscilloscope externally with the signal from TP-11 (DRUM F.F.) of the SERVO board.
2. Play the stairstep signal of alignment tape MH-2.
3. Set the trigger to $\ominus$ slope and observe the CH-1 FM waveform.

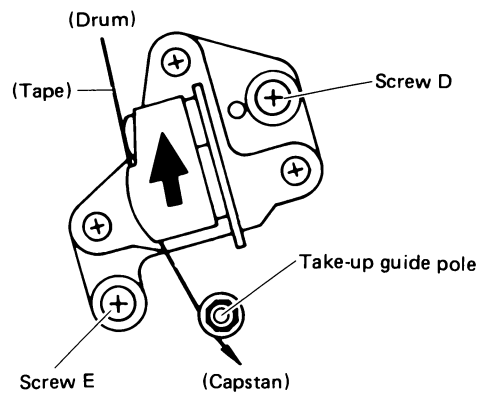


Fig. 2-32 CTL head phase adjustment

- Tracking center adjustment.

- 1) Set the TRACKING knob to center detent position (AUTO).
- 2) Loosen two screws D and E, and slide the A/C head assembly fully in the direction to the take-up guide pole.
- 3) Slightly tighten the two screws, set the A/C head position tool over screw D and insert the pin of the tool into the hole at the side of screw D.
- 4) Observe the FM output level and slowly turn the tool to slide the A/C head assembly in the direction of the arrow as shown in Figure 2-32.
- 5) Set the A/C head assembly to the position where first maximum FM level is obtained. Tighten two screws D and E.

- Servo circuit adjustment

1. Perform the PB/REC switching point adjustments. Refer to sections 3.5.4 and 3.5.5.

- Final checks

1. Connect an oscilloscope to TP-PB. FM (FM OUT) of the SERVO board. Trigger the oscilloscope externally with the signal from TP-11 (DRUM F.F.) of the SERVO board.
 - 1) Supply a video signal and perform recording, then playback. Confirm that the FM waveform also satisfies the specifications during playback of MH-2.
2. Perform overall checks and adjustments of the servo circuit and video circuit.
3. Perform the audio circuit adjustment.

SECTION 3 ELECTRICAL ADJUSTMENTS

3.1 PREPARATION

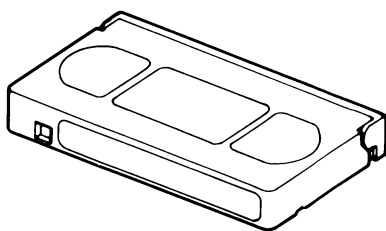
Electrical adjustments are required after replacing circuit components and certain mechanical parts.

It is important to perform these adjustments only after all repairs and replacements have been completed. Also, do not attempt these adjustments unless the proper equipment is available.

3.2 REQUIRED TEST EQUIPMENT AND FIXTURES

1. Color television monitor
2. Oscilloscope: (wide-band, dual trace, triggered delayed sweep)
3. Test signal generator: color bar, stairstep
4. Frequency counter
5. Audio tester (combination audio frequency oscillator and meter)
6. Digital voltmeter
7. Recording tape
8. Regulated DC power supply 12 V

9. MH-2



10. Patch Cord PUJ36857

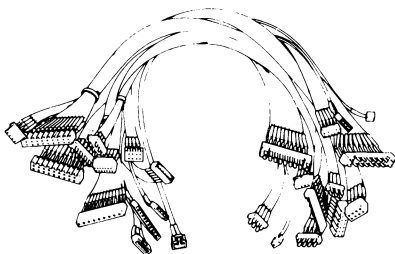
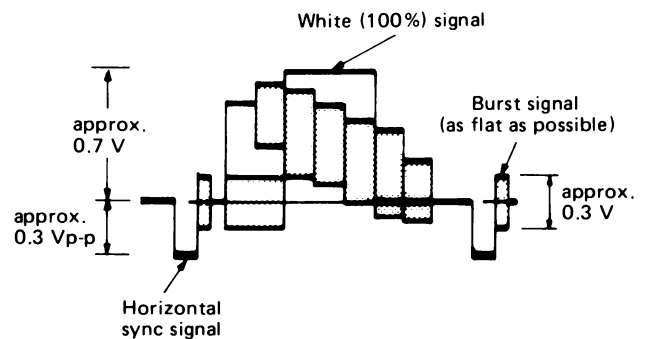


Table 3-1

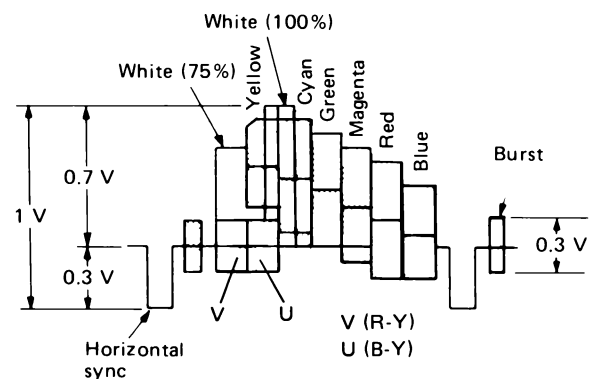
Patch Cord Connection	
Cord Color	Connection
SKY BLUE	MULTI CONNECTOR — 0 2 CN12
GREEN	MULTI CONNECTOR — 0 2 CN11
RED	0 3 CN3 — A/C HEAD
BLACK	0 9 CN1 — 0 2 CN7
YELLOW	0 6 CN1 — 0 2 CN6
WHITE	0 3 CN6 — 0 4 CN1
PINK	0 3 CN2 — 0 2 CN9
BROWN	0 3 CN1 — 0 2 CN8
ORANGE	0 1 CN4 — 0 2 CN14
BLUE	0 1 CN3 — 0 2 CN3
VIOLET	0 1 CN2 — 0 2 CN2
GRAY	0 1 CN1 — 0 2 CN1

Table 3-2



Color-bar signal of pattern generator

Fig. 3-1



Color bar signal waveform

White	Yellow	Cyan	Green	Magenta	Red	Blue
(75%)						
V	U	White 100%		Black		

Color bar pattern

Fig. 3-2

3.2.1 Alignment tape contents

1. MH-2 contents

Segment	Playback Time	Video Signal	Audio Signal	Applications
1	10 minutes	Stairsteps	6 kHz	• Interchangeability checks and adjustments • Servo circuit checks and adjustments • Audio head azimuth adjustments
2	5 minutes	(none)	3 kHz	• Tape speed checks • Wow and flutter checks
3	10 minutes	Color bars	1 kHz (0 dB)	• Video signal playback circuit checks and adjustments • Audio signal playback circuit checks and adjustments
4	3 minutes	RF sweep	(none)	• Video head resonance adjustments • Markers: 2.0, 4.0, 5.0 MHz

Table 3-3

3.3 SWITCHING REGULATOR SYSTEM ADJUSTMENTS (0 2 VIDEO board)

3.3.1 5.25 V DC output voltage

Mode : REC
Digital voltmeter : TP401, TP402
DC Power Supply (12 V) : Battery Terminal

1. Adjust R405 for 5.75 V at TP401.
2. Adjust R408 for 5.25 V at TP402.

3.4 MECHACON SYSTEM ADJUSTMENT (0 1 MECHACON board)

3.4.1 Battery alarm

Mode : STOP
Digital Voltmeter : TP1, TP2
DC Power Supply : Battery Terminal

1. Adjust R28 so that the Battery Alarm indicator appears on the counter display at 11.0 V (TP1).
2. Set the voltage of TP1 11.0 V.
3. Adjust R28 to the rising point the voltage of TP2 (IC3-8) becomes "H".

3.5 SERVO SYSTEM ADJUSTMENTS

(0 3 SERVO board)

3.5.1 Drum pulse level

Mode : REC
Signal : Color bar
Oscilloscope : TP6

Note: Drum Servo must be locked.

1. Adjust R97 so that the positive and negative pulse become 0.7 ± 0.1 Vp-p.

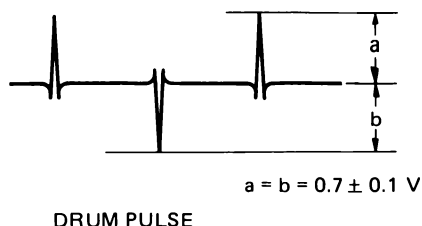


Fig. 3-3

3.5.2 Capstan DISCR. position

Mode : REC
Signal : Color bar
Oscilloscope : TP3

1. Short TP22 to TP-GND.
2. Adjust R15 to stabilize the sampling pulse with respect to the trapezoid. All this time, a slow drift at the rate of less than 40 msec in 5 second is acceptable.

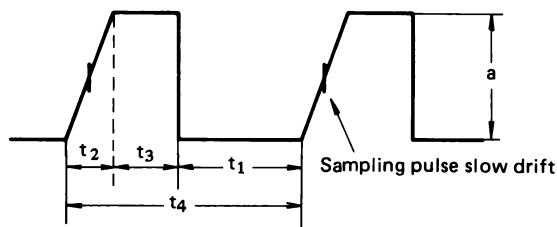


Fig. 3-4

3. Conform following items.

$a \geq 5.0$ V
 $t_2 = 3.2 \pm 0.5$ msec
 $t_1/t_3 = 1$
 $t_4 = 40$ msec

3.5.3 Drum DISCR. position

Mode : REC
Signal : Color bar
Oscilloscope : TP7

1. Short TP21 to TP-GND.
2. Adjust R69 to stabilize the sampling pulse with respect to the trapezoid.
3. Conform following items.

$a > 5.0$ V
 $t_2 = 3.2 \pm 0.5$ msec
 $t_2/t_1 = 1$
 $t_3 = 40$ msec

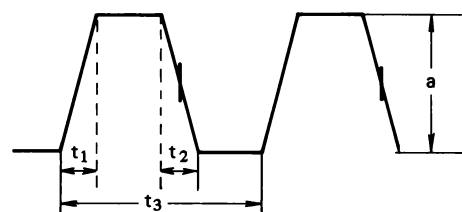


Fig. 3-5

3.5.4 PB switching point

Mode : PB
Signal : Alignment tape (MH-2 Stairsteps)
Oscilloscope : VIDEO OUT

1. Trigger the oscilloscope externally (– slope) with the signal from TP11.
2. Adjust R95 to position the trigger point 6.5 ± 0.5 H before V. sync.

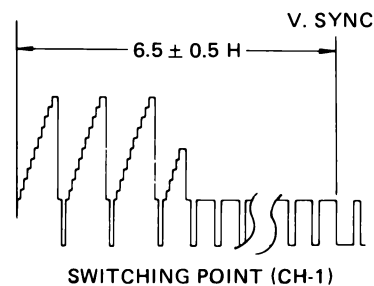


Fig. 3-6

3. Set the trigger slope of the oscilloscope to plus (+).
4. Adjust R93 to position the trigger point 6.5 ± 0.5 H before V. sync.

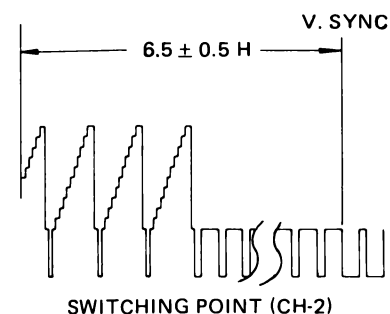


Fig. 3-7

3.5.5 REC switching point

Mode : REC
Signal : Stairsteps
Oscilloscope : VIDEO OUT

1. Trigger the oscilloscope externally (+ slope) with the signal from TP11.
2. Adjust R47 to position the trigger point 6.5 ± 0.5 H before V. sync.

3.5.6 Tracking preset

Mode : SELF REC. after P/B mode
Signal : Stairsteps

1. Preset tracking VR (R36) center crick position.
2. Try several time recording and playback, watch the playback picture at the switching area point.
3. Adjust the R38 to get vertical line straight as possible.

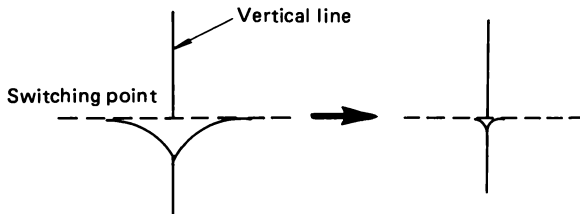


Fig. 3-8

4. After adjustment check the SW PHASE adjustment.

3.5.7 CTL Head position

Refer to mechanical adjustment 2.4.6.

3.5.8 Reverse PB Tracking preset

Mode : REC then Rev. PB
Signal : Color bar

1. Set the tracking control to the center detent position.
2. Adjust R28 to set the noise bar at the bottom of TV screen, but avoiding H. sync disturbance at the top of the picture.

3.5.9 H. discriminator

Mode : Search FF/REW
Signal : Alignment tape (MH-2 Color bar)

1. Adjust R59 to minimize the hue deviation on the TV monitor during SEARCH FF and SEARCH REW mode.

3.5.10 V. pulse

Mode : REC then Still
Signal : Color bar
Oscilloscope : VIDEO OUT

1. Trigger the oscilloscope externally with the signal from TP11.
2. Adjust R101 so that t_2 becomes $100 \pm 20 \mu\text{sec}$.
3. Adjust R103 so that t_3 becomes $250 \pm 50 \mu\text{sec}$.

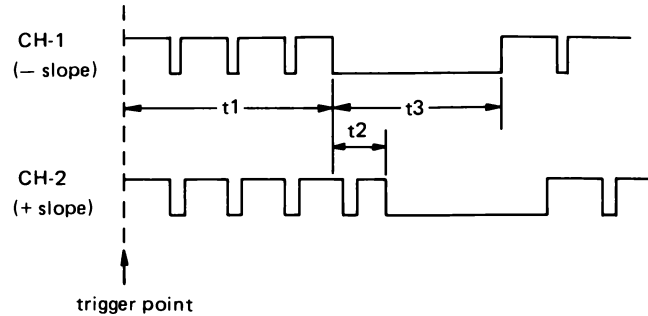


Fig. 3-9

Note: If customer's TV set is available, observe display on screen and adjust R101 (hole located at rear of the unit) to minimize vertical jitter.

3.6 VIDEO SYSTEM ADJUSTMENTS

(0 2 VIDEO board)

3.6.1 Video head resonance & Q adjustment

This adjustment is required only after replacing the upper drum (video heads). There are two adjusting methods. Using a MH-2 alignment tape is much convenient than using a sweeper generator. So that this manual shows both methods.

A: Sweep generators

1. Set for the playback mode without tape. Hook up oscilloscope to pin 8 of IC3 (video board).
2. Connect a sweep generator to TP1, TP2.
3. Adjust C13, C14 for 5.0 MHz peaking.
4. Adjust R1, R2 to get the ratio between 1 MHz and 5.0 MHz level 1 : 2.5 as shown in Fig. 3-10.

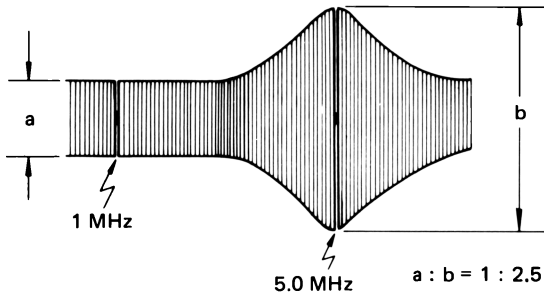


Fig. 3-10

B: Alignment tape method

1. Load the MH-2 alignment tape and playback RF sweep section.
2. Set the oscilloscope to pin 8 of IC3 (video board).
3. Adjust C13, C14 to get the resonance point 5.0 MHz (marker) as shown Fig. 3-11.
4. If the level of CH1 and CH2 differ, adjust the higher level channel to match the lower by setting R1 and R2.
5. Record a video signal; then playback and confirm absence of flicker, black-white reversal in the playback picture. If necessary, adjust R1 and R2 carefully.

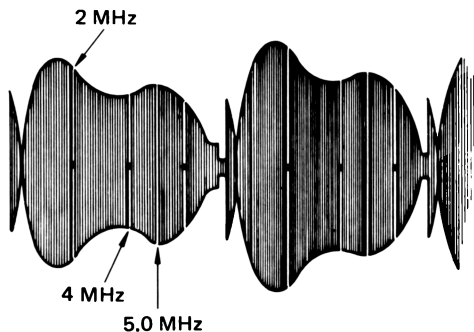


Fig. 3-11

3.6.2 Video E-E level

Mode : E-E
Signal : Color bar
Oscilloscope : VIDEO OUT

1. With load at 75Ω adjust R80 for 0.92 ± 0.03 Vp-p.

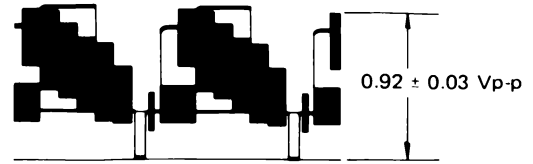


Fig. 3-12

3.6.3 Carrier and deviation

IMPORTANT:

Ordinarily avoid performing this adjustment. It should be performed only if IC7 of the VIDEO board has been replaced or if significant waveform distortion and S/N deterioration occur during recording and playback due to improper adjustment of the carrier set and deviation.

Note: Before adjustment, turn R140 (DARK CLIP) fully counterclockwise and R152 (WHITE CLIP) fully clockwise so that the signal is not limited.

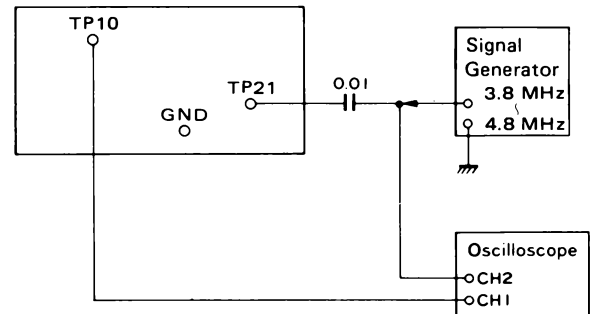


Fig. 3-13

Mode : E-E
Signal : Color bar
Input Select SW : AUX

1. Connect the equipment as shown above figure.
2. Set the oscilloscope to ADD mode and adjust the vertical gain of the oscilloscope and signal generator output to easily observe beat.
3. Set the signal generator for 3.8 MHz and adjust R111 (CARRIER) to set the carrier as shown Fig. 3-14.

- Set the signal generator for 4.8 MHz and adjust R110 (DEVIATION) to set the deviation as shown in Fig. 3-14.

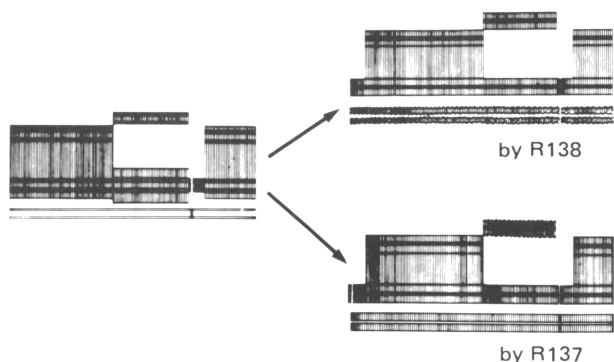


Fig. 3-14

3.6.4 White clip and dark clip

Mode : E-E
Signal : Color bar
Oscilloscope : TP3
Input Select SW : AUX

- With the rated signal level taken as 100%, adjust R84 (WHITE CLIP) so that the white peak overshoot becomes 90%.
- In the same condition, adjust R113 (DARK CLIP) so that the sync tip undershoot becomes 45% as shown below.

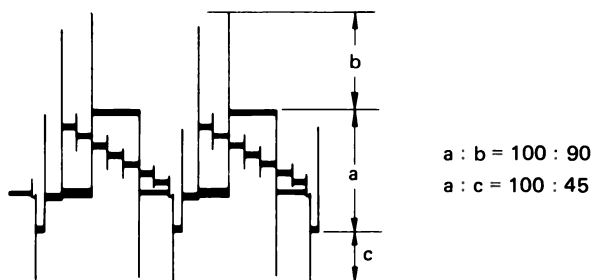


Fig. 3-15

3.6.5 AFC

Mode : E-E
Signal : Color bar
Frequency Counter : TP212

- Connect fixture (below) between TP203 and TP221.
- Adjust R222 to obtain 625 kHz $\pm$ 5 kHz.

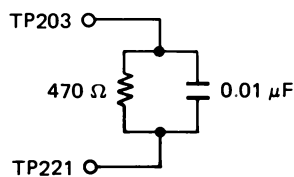


Fig. 3-16

3.6.6 VXO (Variable Crystal Oscillator)

Mode : PB
Signal : Alignment tape (MH-2 Color bar)
Frequency Counter : TP225

- Adjust R220 to obtain 4.433619 MHz $\pm$ 50 Hz.

3.6.7 REC FM level

Mode : REC
Signal : Color bar
Oscilloscope : TP4

- Adjust R86 so that the level of the FM waveform becomes 3.5 Vp-p.

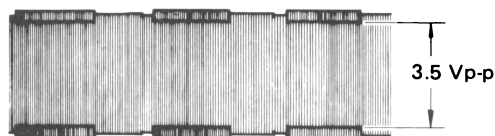


Fig. 3-17

3.6.8 REC Color level

Mode : PB
REC then PB
Signal : Alignment tape (MH-2, color bar)
Oscilloscope : TP204
Input Select SW : AUX

- load the alignment tape MH-2, playback a color bar segment of the MH-2 and observe color signal level.
- Trigger the oscilloscope externally (— slope) with the signal from TP11 of the Servo board. During recording, using a regular tape, adjust R201 so that the playback level becomes 110% as the alignment tape playback.

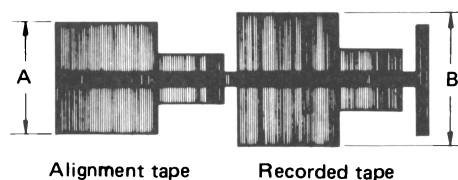


Fig. 3-18

3.6.9 Converter balance

Mode : REC then PB
 Signal : Color bar
 Oscilloscope : TP201
 Input Select SW : AUX
 Trigger of Oscilloscope : TP11 (Servo board)

1. Adjust R239 for minimum leakage of the 5.06 MHz component as shown below.

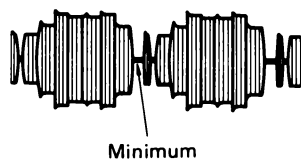


Fig. 3-19

3.6.10 Noise cancel balance

Mode : REC then PB
 Signal : Stairsteps
 Oscilloscope : TP21

1. Adjust R18 for the flat waveform as shown below.

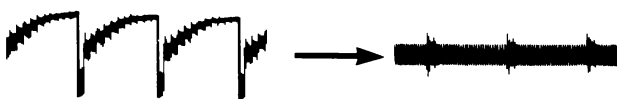


Fig. 3-20

3.6.11 PB Y, burst level

Mode : REC then PB
 Signal : Color bar
 Oscilloscope : VIDEO OUT or TP10
 Input Select SW : AUX

1. With 75Ω load at VIDEO OUT and adjust R14 for a luminance signal level of 0.92 ± 0.05 Vp-p.
2. Adjust R243 for a burst level of 0.27 ± 0.05 Vp-p as shown below.

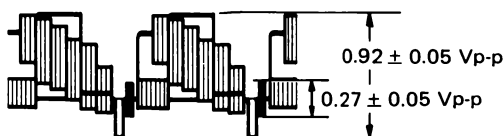


Fig. 3-21

3.6.12 SECAM DET. adjust

Mode : E-E
 Signal : SECAM color bar
 Oscilloscope : TP223
 Input Select SW : AUX

1. Connect oscilloscope TP223. Adjust R257 to get 8.0 Vp-p.
2. Adjust L213 transformer to get waveform following Fig. 3-22.

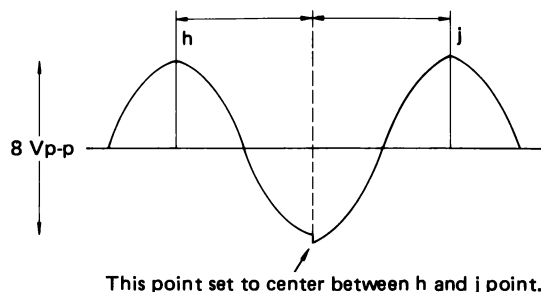


Fig. 3-22

3.7 AUDIO SYSTEM ADJUSTMENT

(07 AUDIO board).

3.7.1 Audio PB level

Mode : PB
Signal : Alignment tape (MH-2 1 kHz)
Oscilloscope : AUDIO OUT

1. Adjust R12 for 0 dB (2.2 Vp-p).

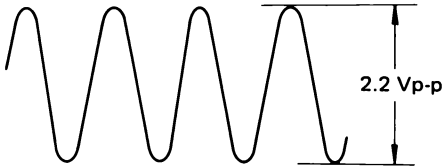


Fig. 3-23

3.7.2 Audio bias level

Mode : REC
Signal : No signal
Digital Voltmeter : Both sides of R1 of the A/C HEAD board (CN1-1, 2)

1. Adjust R31 for 4.4 ± 0.2 mV.

3.7.3 Audio REC level

Mode : REC then PB
Signal : 1 kHz, -10 dBs, VIDEO : Color bar
Oscilloscope : AUDIO OUT
Input Select SW : AUX

1. During recording, adjust R17 to obtain 0 dB (2.2 Vp-p).

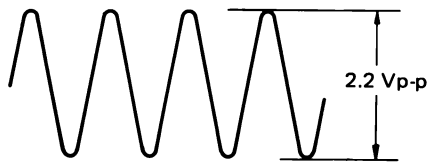


Fig. 3-24

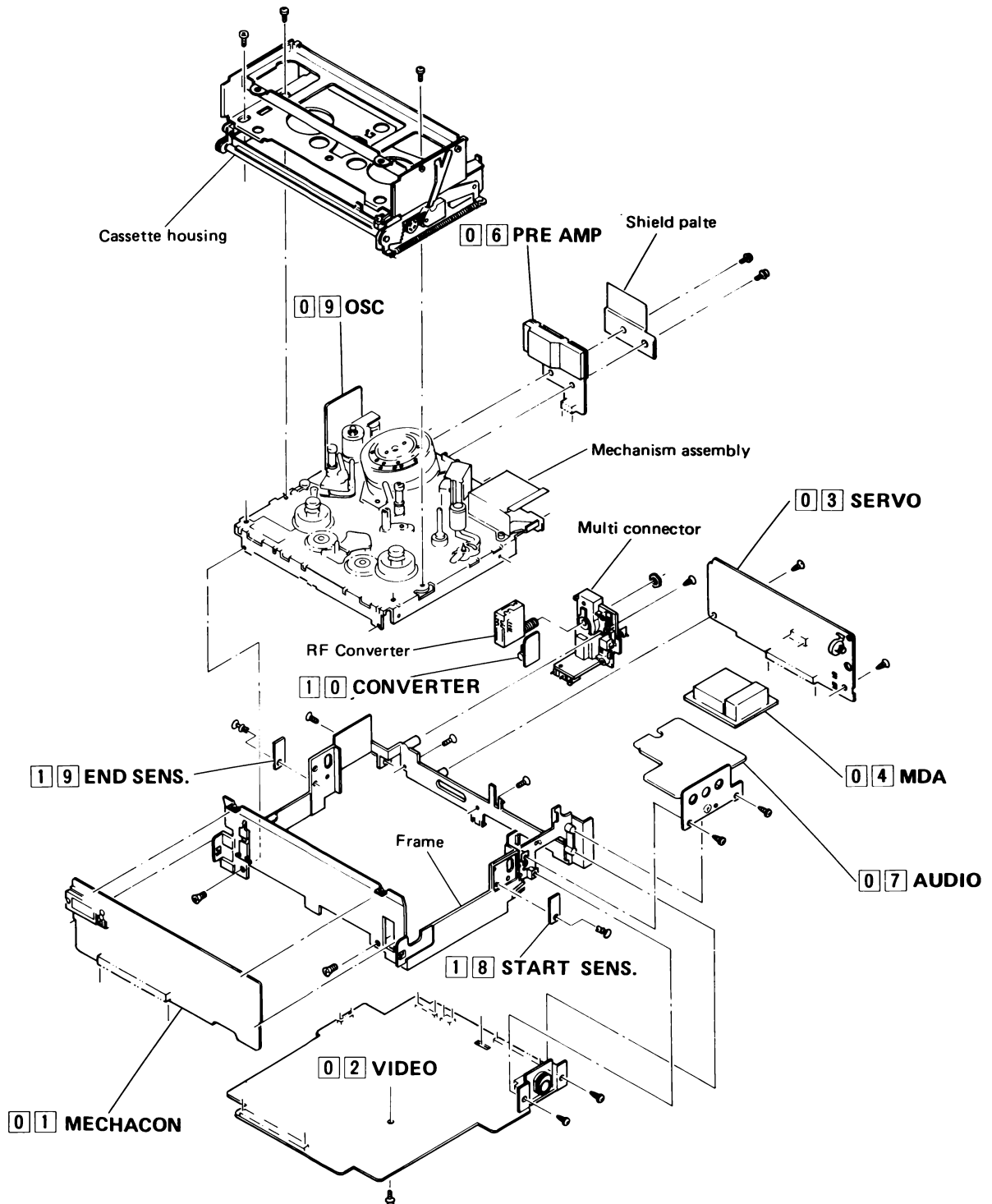
3.7.4 Audio REC/PB frequency response

Mode : REC then PB
Signal : 1 kHz, 10 kHz, 100 Hz, -18 dBs
VIDEO : Color bar
Oscilloscope : AUDIO OUT
Input Select SW : AUX

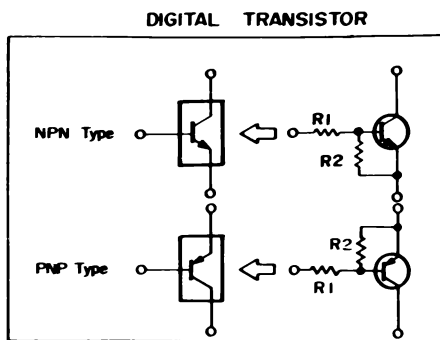
1. During recording, adjust R31 so that during playback, the 10 kHz level becomes ± 3 dB, the 100 Hz level becomes $\pm \frac{3}{6}$ dB, with reference to 1 kHz.

SECTION 4 CHARTS AND DIAGRAMS

4.1 CIRCUIT BOARD LOCATIONS



I.2 DIGITAL TRANSISTOR, IC & TRANSISTORS PACKAGED VIEW



RESISTOR VALUES			
JUNCTION	Part NO.	R1 (K Ω)	R2 (K Ω)
PNP	DTA 114	10	10
	DTA 124	22	22
	DTA 144	47	47
	DTA 144WF	47	22
	DTA 114Y	10	47
	DTA 114T	10	OPEN
	2SA1345	47	47
	2SA1346	22	22
NPN	DTC 114	10	10
	DTC 124	22	22
	DTC 144	47	47
	DTC 144WT	47	22
	DTC 114Y	10	47
	DTC 143T	4.7	OPEN
	2SC3399	47	47
	2SC3400	22	22

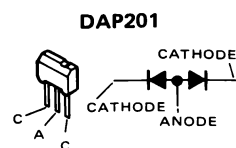
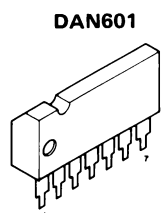
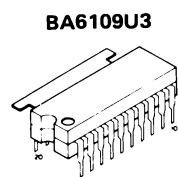
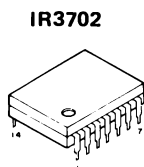
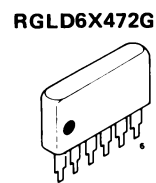
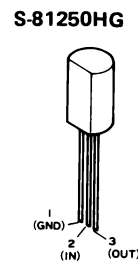
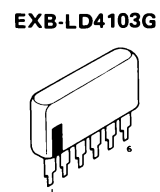
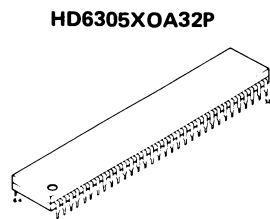
Note: The digital transistor includes built in resistors.

It features small size and high reliability.

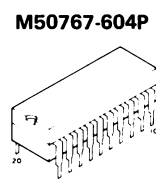
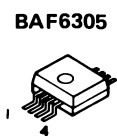
Both PNP and NPN types are available.

USES: INVERTER, INTERFACE, DRIVER CIRCUITS.

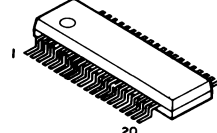
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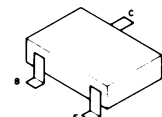
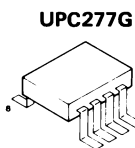
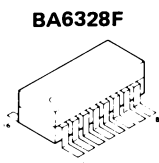
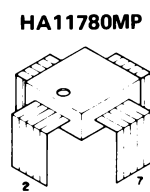
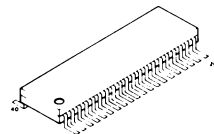
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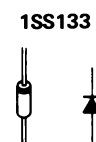
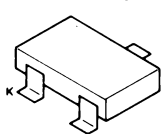
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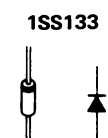
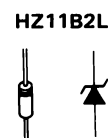
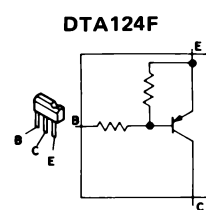
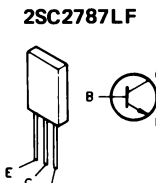
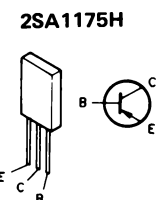
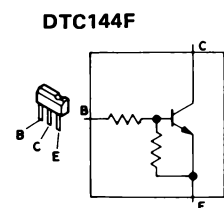
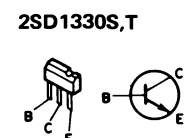
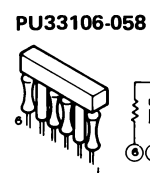
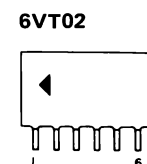
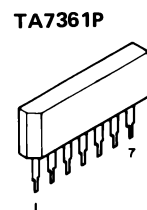
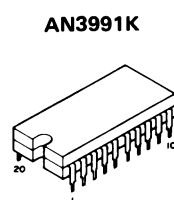
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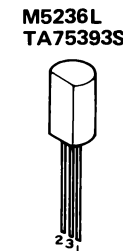
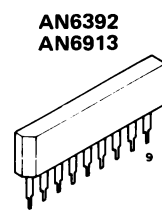
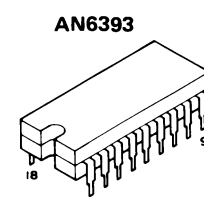
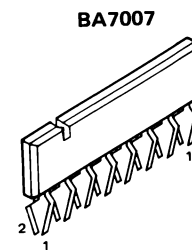
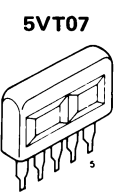
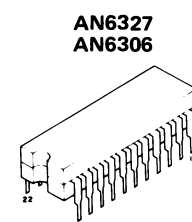
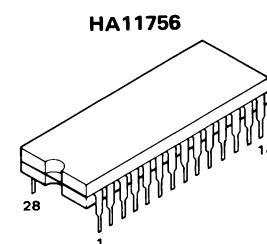
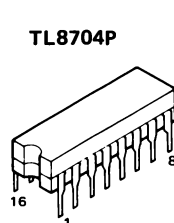
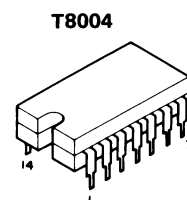
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DA204KT
DAN202KT**



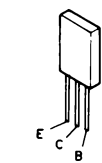
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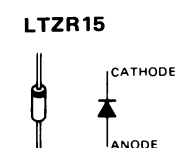
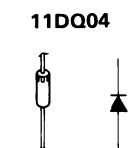
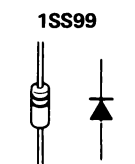
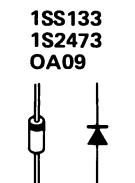
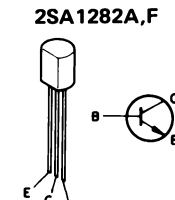
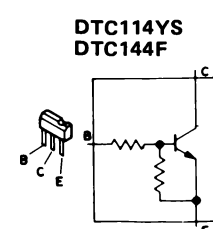
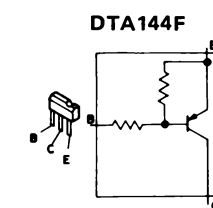
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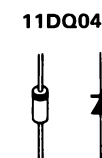
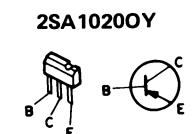
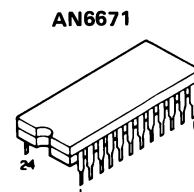
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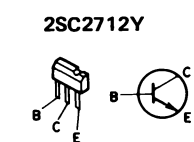
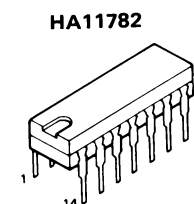
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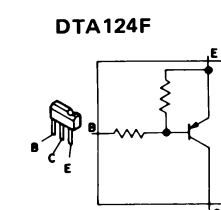
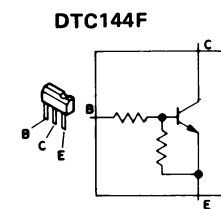
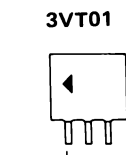
— MDA —



— PRE AMP —



— OSC —



4.3 KEY TO ABBREVIATIONS

A	AC	: Alternating Current
	ACC	: Automatic Color Control
	A/CTL	: Audio/Control
	ADD	: Adder
	ADC	: Analog to Digital Converter
	ADJ	: Adjustment
	A DUB	: Audio Dub
	AE	: Audio Erase
	AEF	: Automatic Editing Function
	AFC	: Automatic Frequency Control
	AFT	: Automatic Fine Tuning
	AGC	: Automatic Gain Control
	AH	: Audio Head
	AHD	: Audio High Density
	AL	: After Loading
	ALC	: Automatic Ligh Compensation Automatic Level Control
	A/S/M	: Audio/Servo/Mechacon
	ALM	: Alarm
	ALU	: Arithmetic Logic Unit
	AM	: Amplitude Modulation
	AMP	: Amplifier
	ANT	: Antenna
	APC	: Automatic Pedestal Control Automatic Phase Control
	APL	: Average Picture Level
	ASS'Y	: Assembly
	ATT	: Attenuator
	AUTO	: Automatic
	AUX	: Auxiliary
	AUD	: Audio

B	B	: Base
	BAL	: Balance
	BATT	: Battery
	BBD	: Bucket Brigade Device
	BCD	: Binary Coded Decimal
	BEG	: Beginning
	BFP	: Burst Flag Pulse
	BUFF	: Buffer
	BIT	: Binary Digit
	BLK	: Black
	BLU	: Blue
	BNC	: Bayonet Connector
	BOT	: Beginning of Tape
	BPF	: Bandpass Filter
	BRK	: Brake
	BRN	: Brown
	BRT	: Brightness
	BT	: Band Tuning
	BW or B/W	: Black and White

C	C	: Capacitance
	CAP	: Capstan
	CAR	: Carrier
	CASS	: Cassette
	CCT	: Circuit
	CdS	: Cadmium Sulphide
	CD	: Countdown
	CF	: Ceramic Filter, Color Frame
	CC	: Cassette Compartment
	CE	: Chip Enable
	CH	: Channel
	CHG	: Charge
	CHROMA	: Chrominance
	CLK	: Clock
	CLR	: Clear
	CMOS	: Complementary Metal Oxide Silicon
	CMD	: Command
	CNT	: Count, Counter
	CONV	: Converter
	COL	: Color
	COM	: Common
	COMB	: Combination Comb Filter
	COMP	: Comparator Composite Compensation

CONN	: Connector
CPC	: Capstan Phase Control
CTC	: Crosstalk Cancel
CPU	: Central Processing Unit
CTL	: Control

D	D	: Drum
	DAC	: Digital to Analog Converter
	dB	: Decibel
	DC	: Direct Current
	DD	: Direct Drive
	DEC	: Decoder
	DEM0D	: Demodulator
	DEM0X	: Demultiplexer
	DET	: Detector
	DEV	: Deviation
	DFRS	: Drum Free RUN STOP
	DIF TRANS	: Differential Transformer
	DISCR	: Discriminator
	DL	: Delay Line
	DOC	: Dropout Compensator
	DPC	: Drum Phase Control
	DYAC	: Dynamic Aperture Control

E	E	: Edit
	EDP	: Electronic Data Processing
	E-E	: Electric to Electric
	EF	: Emitter-Follower
	EMP	: Emphasis
	ENC	: Encoder
	EN	: Enable
	ENV	: Envelope
	EOT	: End of Tape
	EP	: Extended Play
	EQ	: Equalizer
	ES	: Electronic Switch
	ESNS	: End Sensor
	EXP	: Expander
	EXT	: External

F	F	: Farad
	F ADV	: Frame Advance
	FDP	: Fluorescent Display Panel
	FE	: Full Erase
	FET	: Field Effect Transistor
	FF	: Fast Forward Flipflop
	FG	: Frequency Generator
	FM	: Frequency Modulation
	FMA	: FM Audio
	FR	: Full Recording, Frame
	FREQ	: Frequency
	F-V CONV	: Frequency to Voltage Converter
	FWD	: Forward
	FWD S	: Forward Search

G	G	: Green
	GEN	: Generator
	GND	: Ground
	GRN	: Green
	GRY	: Gray

H	H	: High
	HBF	: Horizontal Burst Flag
	HD	: Horizontal Drive
	HG	: Hall Generator
	HPF	: Highpass Filter
	Hz	: Herz

I	IC	: Integrated Circuit
	ID	: Identification (Pulse)
	IF	: Intermediate Frequency
	IFR	: Infrared
	IFT	: Intermediate Frequency Transformer

IND	: Indicator
INH	: Inhibit
INS	: Insert
INT	: Internal, Interrupt
INV	: Inverter
I/O	: Input/Output
IR	: Infrared

L	L	: Low
	LED	: Light Emitting Diode
	LIN	: Linearity
	LIM	: Limiter
	LOAD	: Loading (Cassette)
	LP	: Long Play
	LPF	: Lowpass Filter
LSB	: Lower Sidedband	

M	M	: Motor
	MAX	: Maximum
	MDA	: Motor Drive Amplifier
	MECHACON	: Mechanism Control
	MIC	: Microphone
	MIN	: Minimum
	MIX	: Mixer
	MMV	: Monostable Multivibrator
	MOD	: Modulation
	MODEM	: Modulator-Demodulator
	MON	: Monitor
	MOS	: Metal Oxide Silicon
	MPX	: Multiplexer
	MS	: Mode Select
	MUT	: Muting

N	NAND	: Not-And
	NC	: Not Connected
	NFB	: Negative Feedback
	NLN	: Non-Linear
	NO	: Normally Open
	NOR	: Normal

O	OPAMP	: Operational Amplifier
	OP	: Operation
	ORN	: Orange
	OSC	: Oscillator

P	PB	: Playback
	PC	: Photocoupler, Pulse Counter
	PCM	: Pulse Code Modulation
	PGM	: Program
	PG	: Pulse Generator
	PI	: Photo Interrupter
	PLL	: Phase Locked Loop
	p-p	: Peak-to-Peak
	POS	: Position
	PR	: Pinch Roller
	PREAMP	: Preamplifier
	PRL	: Perroll
	P/S	: Pause/Still
	PSC	: Pulse Swallowing Control
	PU	: Pickup
	PWB	: Printed Wiring Board
	PWM	: Pulse Width Modulation
	PWR	: Power

Q	Q	: Quality Factor
---	---	------------------

R	R	: Red
	RA	: Resistor Array
	RAM	: Random Access Memory
	REC	: Recording
	REG	: Regulated
	REM	: Remote
	REMOCON	: Remote Control (Unit)
	REV	: Reverse
	REV S	: Reverse Search

REW	: Rewind
RF	: Radio Frequency
RS FF	: RS Flipflop
RST	: Reset
R/P	: Record/Playback
RPT	: Repeat
RT	: Rotary Transformer
RUN	: Running
RY	: Relay

S	SC	: Subcarrier, Simulcast
	SAW	: Sawtooth
	SCH	: Search
	SEL	: Select
	SENS	: Sensor
	SEP	: Separator
	SF	: Source Follower
	SFF	: Short Fast Forward
	SIF	: Sound Intermediate Frequency
	SN	: Signal to Noise Ratio
	SOL	: Solenoid
	SOS	: Sound on Sound
	SP	: Standard Play
	SR	: Supply Reel
	SREW	: Short Rewind
	S/S	: Slow/Still
	SSG	: Sync Signal Generator
	SSNS	: Start Sensor
	STD	: Strobe Data
	SUP	: Supply
	SW	: Switch
	SWD	: Switched
	SYNC	: Synchronization
	SYSCON	: System Control

T	TBC	: Time Base Corrector
	TP	: Test Point
	TPZD	: Trapezoid
	TR	: Transistor; Transformer
	TU	: Take-Up
	TC	: Tension Control, Time code
	TAL	: Tally
	TEN	: Tension
	TK	: Tracking
	TIM	: Timing
	T/T	: Tuner/Timer

U	UL	: Unloading
	UNREG	: Unregulated
	UNSW	: Unswitched

V	V	: Volt
	V	: Volt
	VACT	: Video Action
	VCO	: Voltage Controlled Oscillator
	VD	: Vertical Drive
	VIF	: Video Intermediate Frequency
	VR	: Variable Resistor
	VS	: Video and Sync
	VXO	: Variable Crystal Oscillator
	VLT	: Violet
	V/T	: Video/Television
	V/U	: VHF/UHF
	VSCH	: Variable Search

W	W	: Watt
	WHT	: White
	WV	: Working Voltage
	W & D	: White and Dark
	WARN	: Warning

X	XTAL	: Crystal
---	------	-----------

Y	Y	: Luminance
	YEL	: Yellow

4.4 MECHACON OPERATION/MODE SHIFT TABLE

4.4.1 After Power ON

- 1. The STOP LED lights (to provide power ON indication).
- 2. Stop mode is entered.
- 3. If tape is loaded, unloading is performed, then the Stop mode entered.
- 4. If REC Lock has been set, the REC Pause mode is entered.

4.4.2 Conditions Yielding Stop Mode

- 1. The Stop mode is entered automatically when the leader or trailer tape at the beginning or end of the tape is detected.
- 2. The battery graphic of the counter display flashes when the power supply voltage at Mechacon board TP1 declines to approximately 11 V. Further decline to approximately 10.5 V yields the Stop mode, after which power is cut off.
- 3. In event of moisture condensation, the droplet graphic of the counter display flashes and all operations are inhibited. All mode indicating LEDs extinguish.
- 4. If Pause operation (i.e., REC Pause, A. DUB Pause, Insert Pause, or Still) continues for longer than approximately 5 minutes, the Stop mode is entered automatically.
- 5. With the counter MEMORY switch ON (M graphic displayed) in the Fast Forward or Rewind mode, the Stop mode is entered when the counter display coincides with the value at the time the MEMORY switch was set.

4.4.3 Warning Indication

If the REC Safety switch is open (cassette tab absent) during Timer Recording, the PLAY LED flashes.

4.4.4 Emergency Mode Conditions

In this state, the Stop mode is first entered and the corresponding LED flashes for approximately 10 seconds, then power is cut off.

- 1. If more than about 10 seconds elapse before completion of loading or unloading. The REV PLAY LED flashes.
- 2. After pressing an operation button, if more than 10 seconds elapse before shifting to the selected mode. The STILL/PAUSE LED flashes.
- 3. During REC, Play, Audio Dub, Insert, Frame Advance, FF, or REW mode, If take-up disk rotation stops for 2 to 7 seconds. In the Reverse Play mode, this applies to the supply reel disk. The INSERT LED flashes.
- 4. Absence of the drum flip-flop input for 4 to 6 seconds in modes when the head drum should be rotating (i.e., Loading, Recording, play, Reverse play, Audio Dub, Insert and Still/Pause). The REW LED flashes.

WARNING/EMERGENCY TABLE

No.	CAUSE	INDICATOR	Final CONDITION
1	Battery voltage down	() sign on the counter display starts to flash.	All indicator LED turn OFF
2	The unit get moisture	() sign on the counter starts to flash.	All indicator LED turn OFF
3	Loading/unloading failure	The REV, PLAY, LED starts to flash	Power OFF
4	Mode shift function failure	The PAUSE/STILL LED starts to flash	Power OFF
5	Missing Reel FG. pulse	The INSERT LED starts to flash	Power OFF
6	Missing Drum pulse	The REW LED stavts to flash	Power OFF

4.4.5 REC Lock Operation

In the REC Pause mode, setting power OFF, then returning power ON yields the REC Pause mode.

- 1. This function is performed only when tape is loaded. The Pause mode is entered for approximately two seconds, then Play-back is performed for about one second. Afterwards, the Recording mode is entered.
- 2. In the REC Lock state, with the camera at stand-by (Camera Pause), return of power yield the REC Pause mode.
- 3. In the case of the GZ-S3, the Pause mode is entered. The Recording mode is not obtained unless the START switch is set to ON.
- 4. With camera models that hold the START switch position, after return of power, operation is as described in above 1.

4.4.6 Timer Switch ON (TU-S10 Connected)

- 1. With the TU-S10 connected for timer recording (TIMER switch ON), the Recording mode is entered when the "TIMER REC" High potential output is obtained from the TU-S10 CPU.
 - * From the Stop state, loading is performed, then the Recording mode entered.
 - * In the REC Lock setting, the Recording mode is entered immediately.
 - * At completion of timer recording, back-space is performed, then the power is cut off in the REC Pause state.
- 2. While timer recording is in progress, key button operations are inhibited.
- 3. During timer recording of a camera signal, the Recording mode is entered even if the camera START/STOP switch is at the STOP position.

4.4.7 Pause Mode

- 1. When shifting from Recording to Pause, 30 frames of the tape are rewound. However, if the camera trigger is employed, the 30 frames are played back in reverse.
- 2. At the return from REC Pause to Recording, 26 of the frames are played back, then Recording is started with the remaining 4 frames overlapped.

- 3. Simultaneously pressing the REC and PAUSE/STILL keys yields the operation of above item 1 (after completion of loading).
- 4. Operations in the A. Dub Pause mode are essentially the same as those of the REC Pause mode. However, pressing the A. DUB and PAUSE/STILL keys produces 30 frames back-space, then the A. Dub Pause mode is entered.

4.4.8 REC Safety

With the REC Safety switch OFF, all Recording mode operations are inhibited. These include Recording, Audio Dub, Insert, Timer Recording, etc.

4.4.9 Speed Selection

- 1. In the Recording mode, the user selects the tape speed for SP (standard) or EP (3 x).
- 2. During play-back, the speed set by the SP/EP switch is initially entered, then the control signal from the tape and capstan FG signal are compared for automatically selecting the play-back speed.
- 3. If the control signal is absent from the tape, the speed selected by the SP/EP switch is first entered, then the SP speed is entered.
- 4. Recorded speed is also detected in the Search FF and REW modes.
- 5. In the Reverse Play mode, if the tape recorded speed changes, the tape speed is automatically selected.

- 6. When the leader section at the beginning of the tape is detected in the Reverse Play and Search Rewind modes, the Play mode is automatically entered.

4.4.10 Insert Mode

- 1. When the control signal is absent from the tape, the Insert mode is inhibited.
- 2. If the control signal ceases during Insert, the Play mode is selected.
- 3. With the MEMORY switch ON during Insert, when the counter indication coincides with that at the time the MEMORY was set, the Play mode is entered.
- 4. If the SP/EP switch is positioned at the wrong setting during Insert, the Insert operation proceeds automatically at the speed of the underlying recorded segment of tape. However, if the Insert is performed between the points where recording speed was changed, picture loss or disturbance may occur.
- 5. The above condition (4) also applies to the Audio Dub mode.

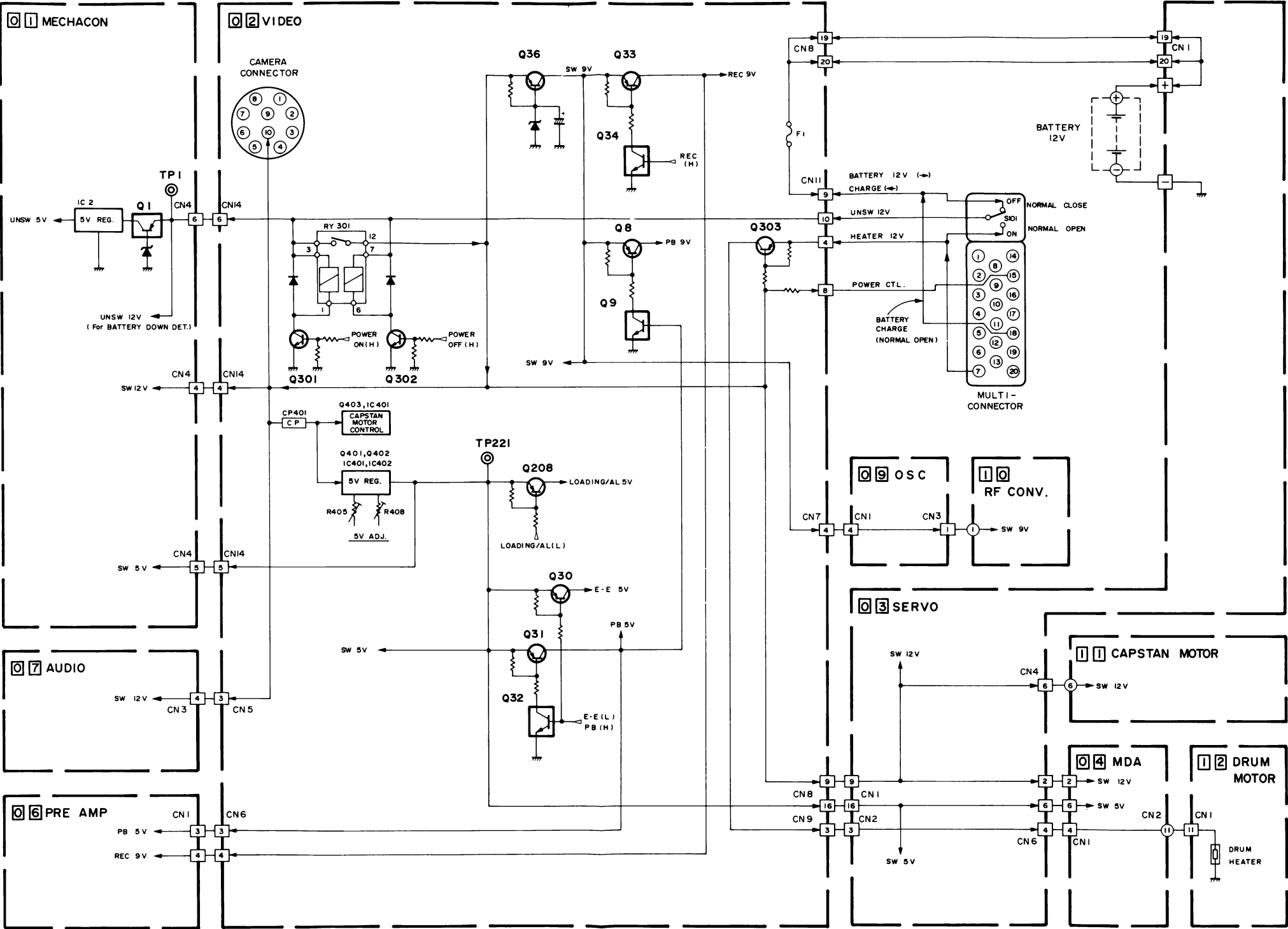
4.4.11 Remote Control (TU-S10 Connected)

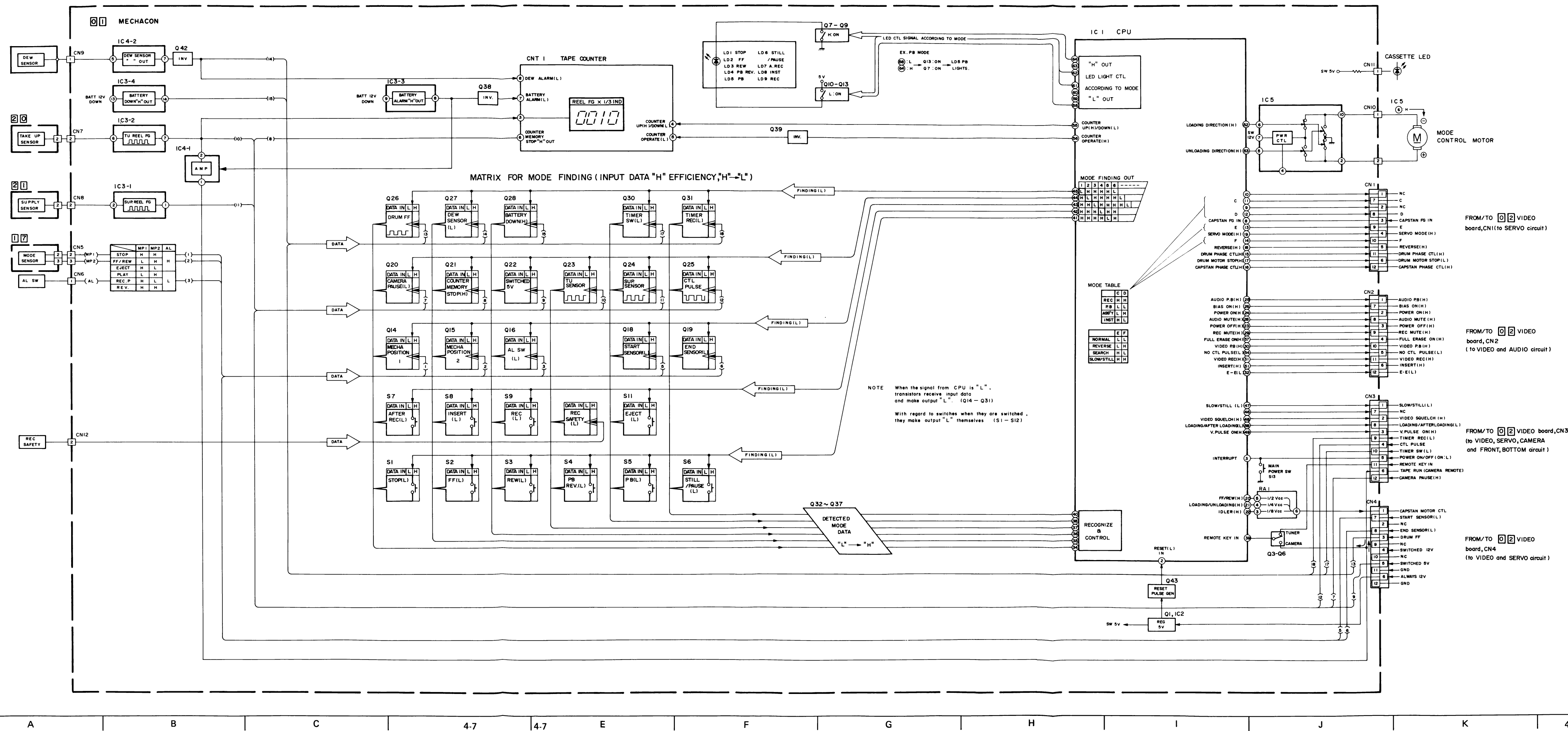
- 1. Mainframe operating keys have priority over those of the wireless remote control unit.
- 2. Channel selection from the wireless remote control unit is enabled in all modes except Recording.

KEY OPERATION \ CURRENT MODE	STOP	P B	P B REV	STILL FORWARD	SEARCH F F	SEARCH REW	F F	REW	REC	REC PAUSE	INSERT	INSERT PAUSE	A REC	A REC PAUSE
STOP	×	○	○	○	○	○	○	○	○	○	○	○	○	○
P B	○	×	○	○	○	○	○	○	×	○	×	○	×	○
P B REV	○	○	×	○	○	○	○	○	×	×	×	×	×	×
STILL PAUSE	×	○	○ FRAME ADVANCE	○ FRAME ADVANCE	○	○ FRAME ADVANCE	×	×	○	×	○	×	○	×
F F	○	○ SEARCH	○ SEARCH	○ SEARCH	×	○ SEARCH	×	○	×	×	×	×	×	×
REW	○	○ SEARCH	○ SEARCH	○ SEARCH	○ SEARCH	×	○	×	×	×	×	×	×	×
REC + P B	○	○	○	○	○	○	○	○	×	○	×	×	○	○
REC + S P	○	○	○	○	○	○	○	○	○	×	×	×	○	○
INSERT + P B	×	×	×	×	×	×	×	×	×	×	×	○	×	×
INSERT + S P	×	×	×	○	×	×	×	×	×	×	○	×	×	×
A REC + P B	○	○	○	○	○	○	○	○	×	×	○	○	×	○
A REC + S P	○	○	○	○	○	○	○	○	×	×	○	○	○	×
POWER	○	○	○	○	○	○	○	○	○	○	○	○	○	○
EJECT	○	×	×	×	×	×	×	×	×	×	×	×	×	×

○ : Inhibited (Mode does not change)
○ : Enabled (Mode changes)

4.5 ELECTRIC POWER PATH BLOCK DIAGRAM





6



5

4

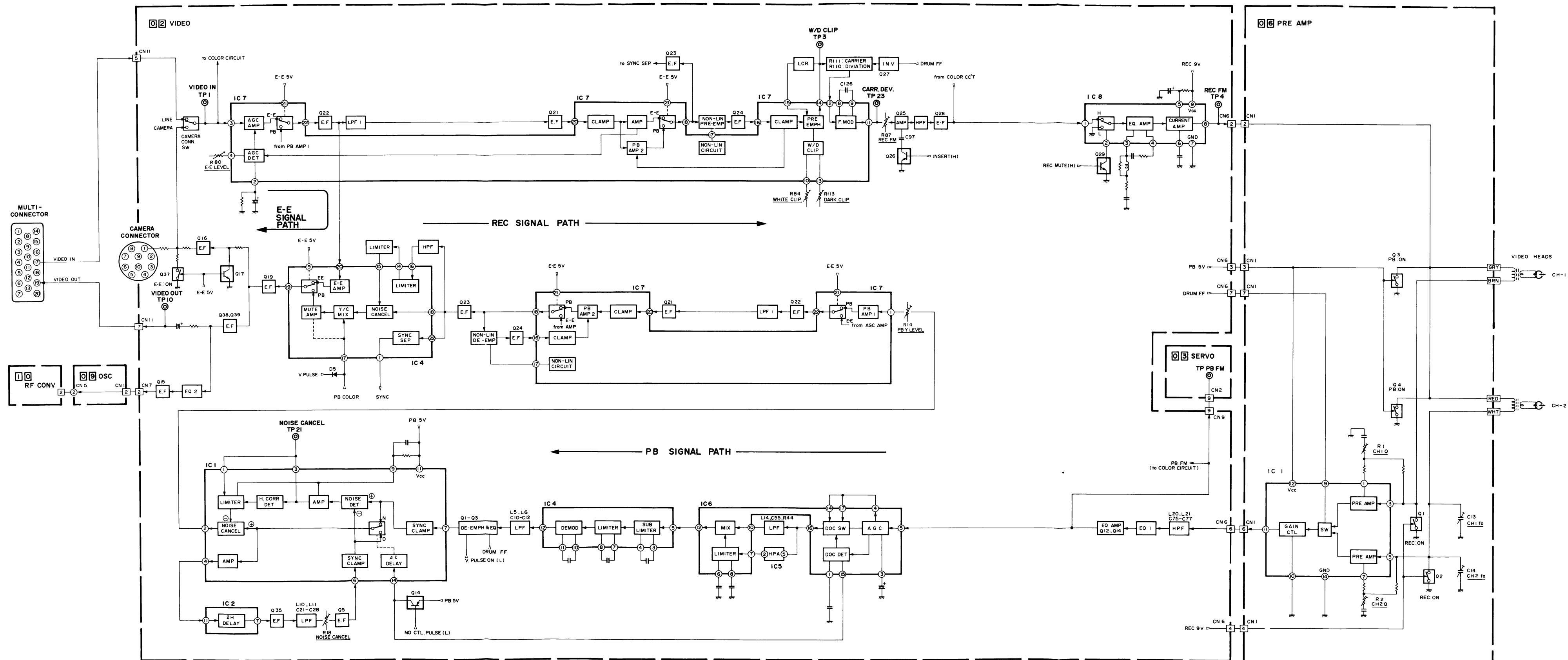
3

2

1



4.9.1 Luminance signal system

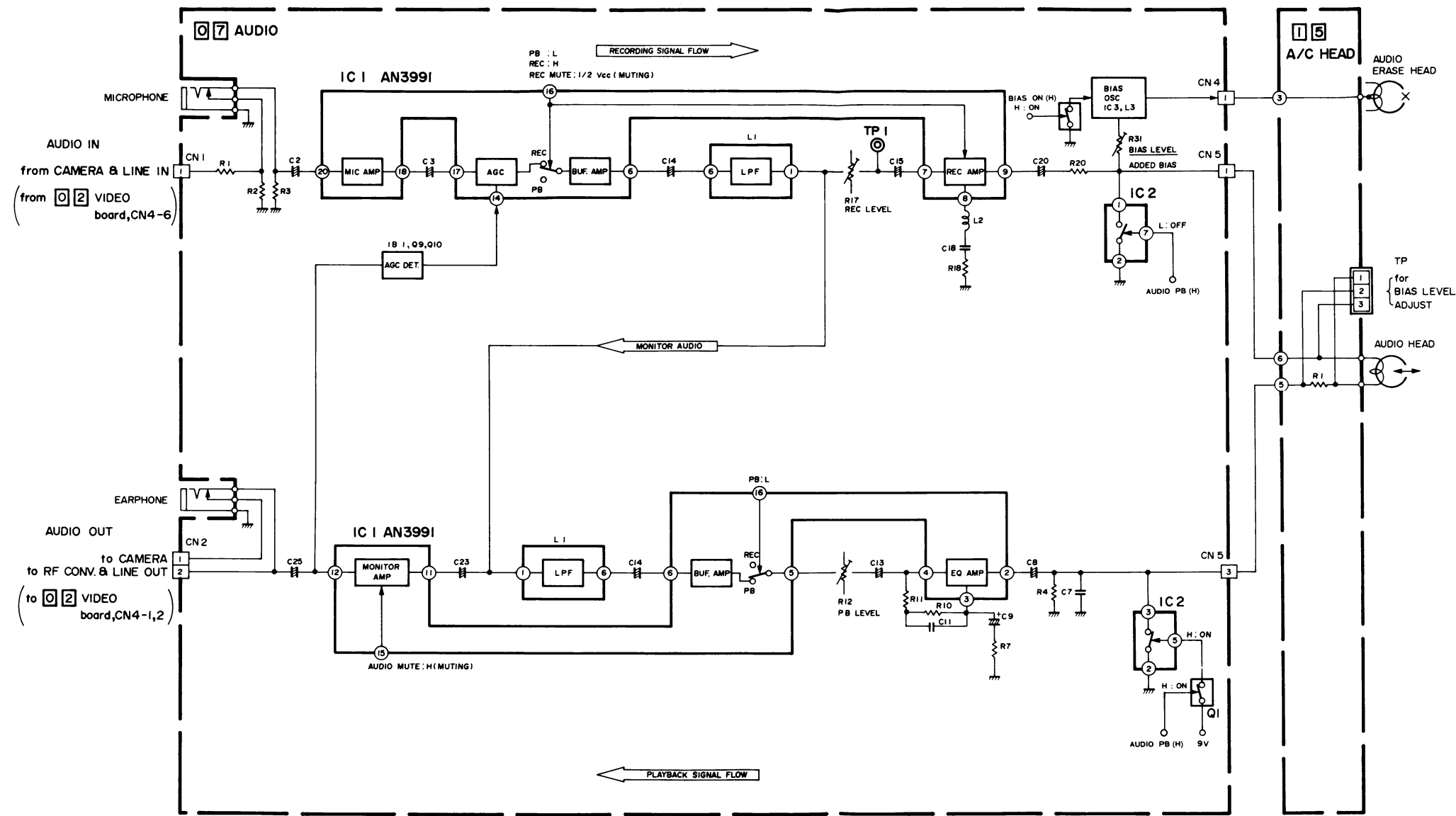


5

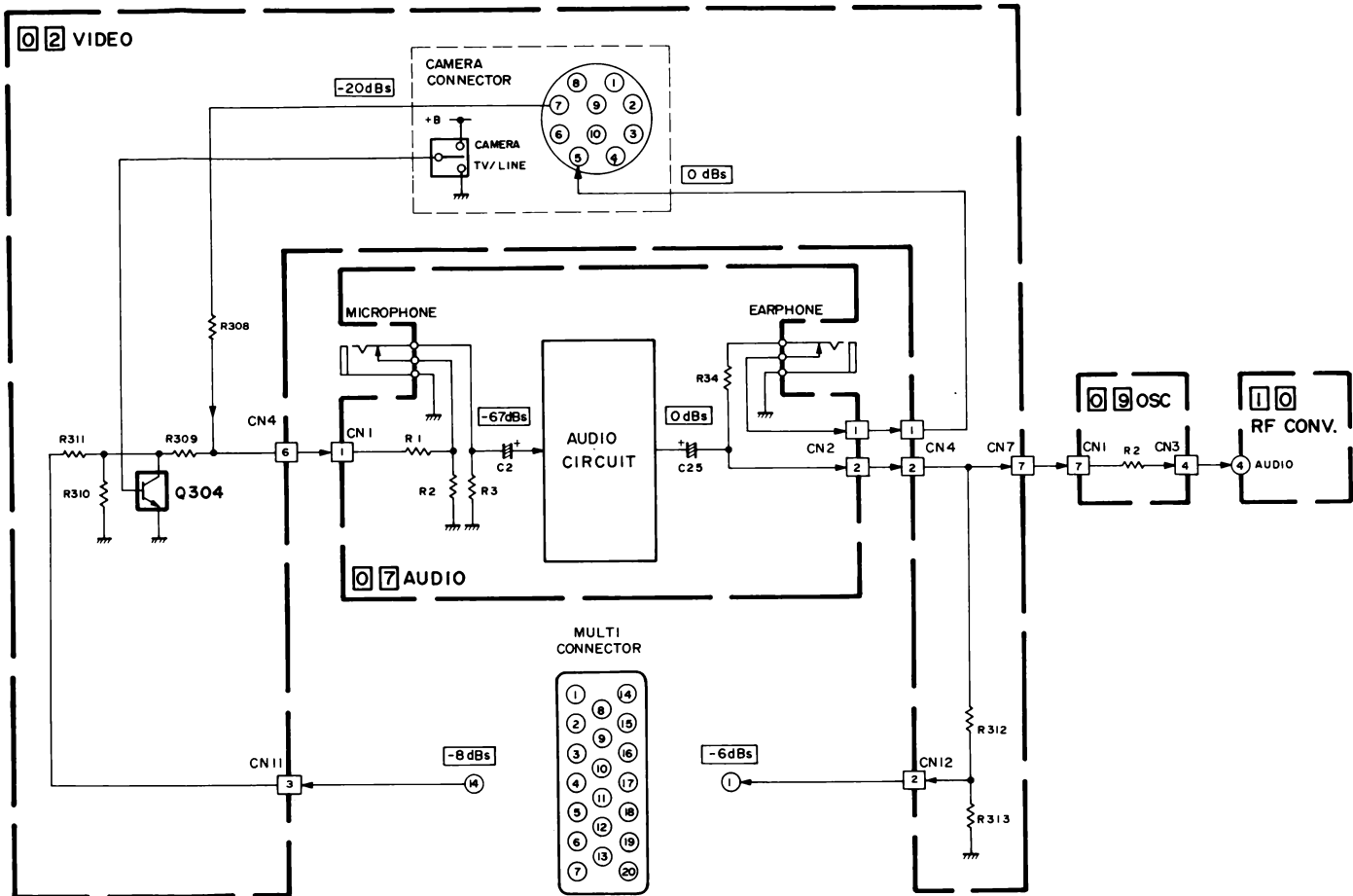


4.10 AUDIO BLOCK DIAGRAM

4.10.1 Audio block diagram



4.10.2 Audio signal path





4

3

2

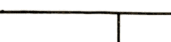
1

△

•

R15

R38



C

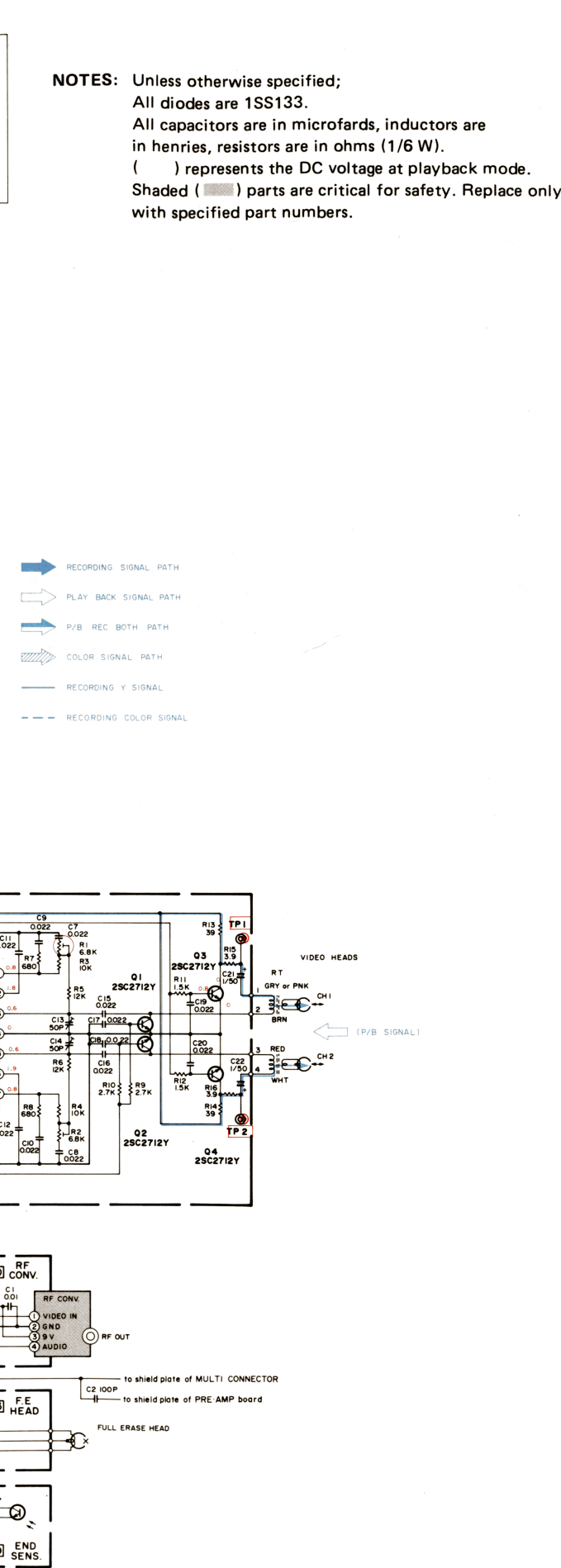
Q : T

D : D

D : D

D : D

A	D
---	---



 RECORDING SIGNAL PATH
 PLAY BACK SIGNAL PATH
 P/B REC BOTH PATH
 COLOR SIGNAL PATH
 RECORDING Y SIGNAL
 RECORDING COLOR SIGNAL

[illegible][illegible]

— VIDEO —

R408 +5V-2 TP401 R110 DEVIATION R405 +5V-1 TP3 TP GND

R243 PB BURST R51 RF EQ TP10 TP4

TP402

R111 CARRIER

R80 E-E LEVEL

R113 D-CLIP

R84 W-CLIP

R87 REC FM

TP23

TP1

R18 NOISE CANCEL

R14 PB Y LEVEL

TP21

TP212

TP204

R239 CONV BALANCE

TP225

TP203

TP201

R222 AFC

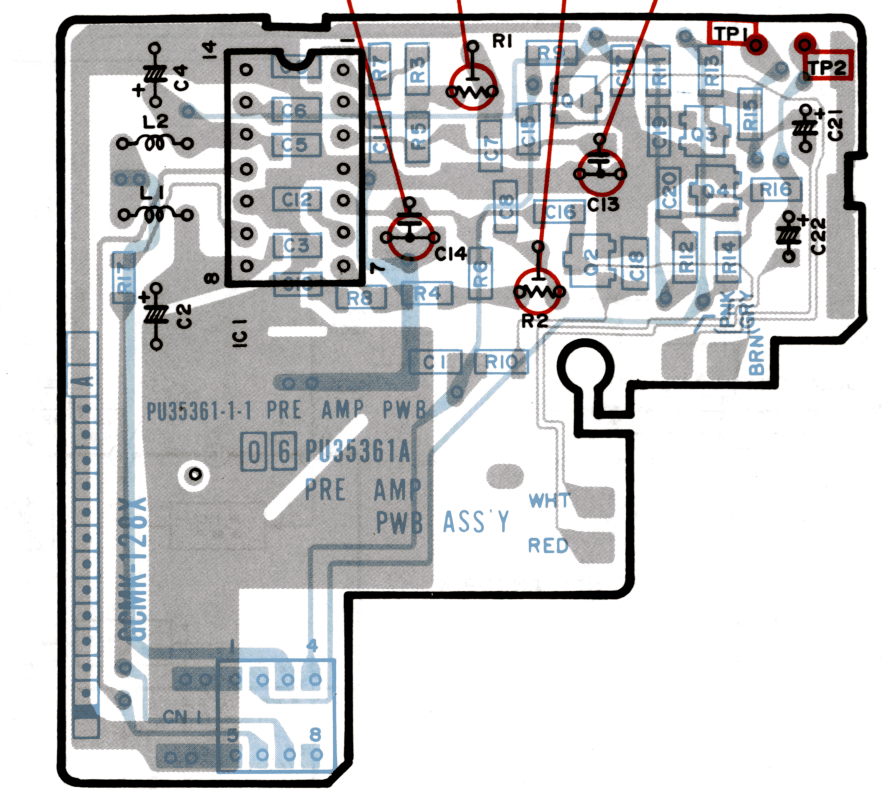
R201 REC COLOR

R257 S.DET

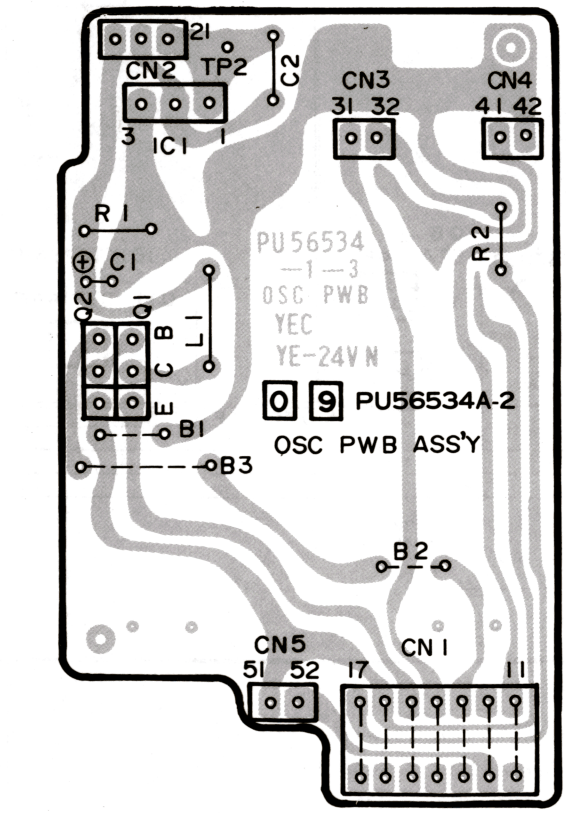
TP223

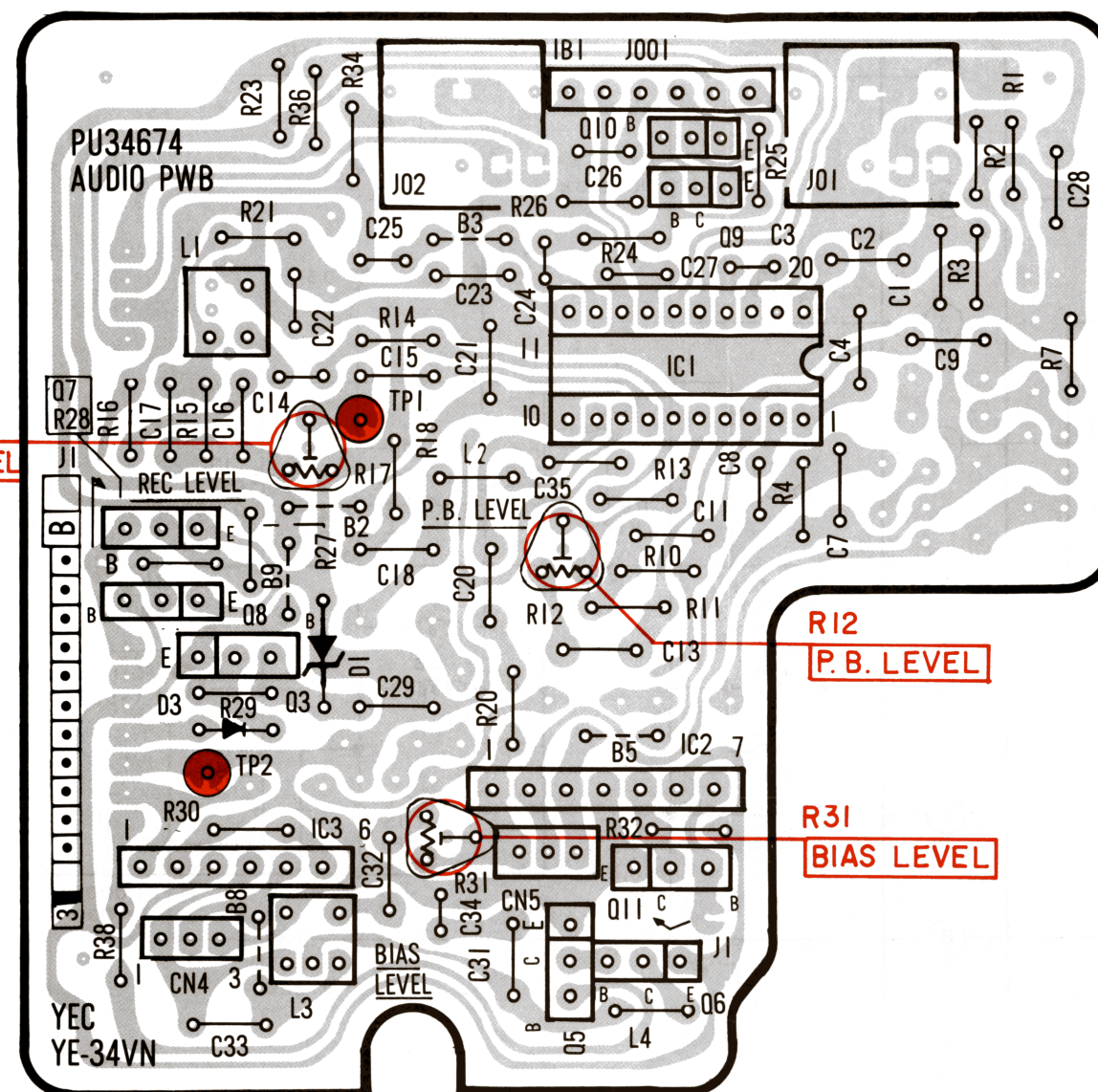
— PRE AMP —

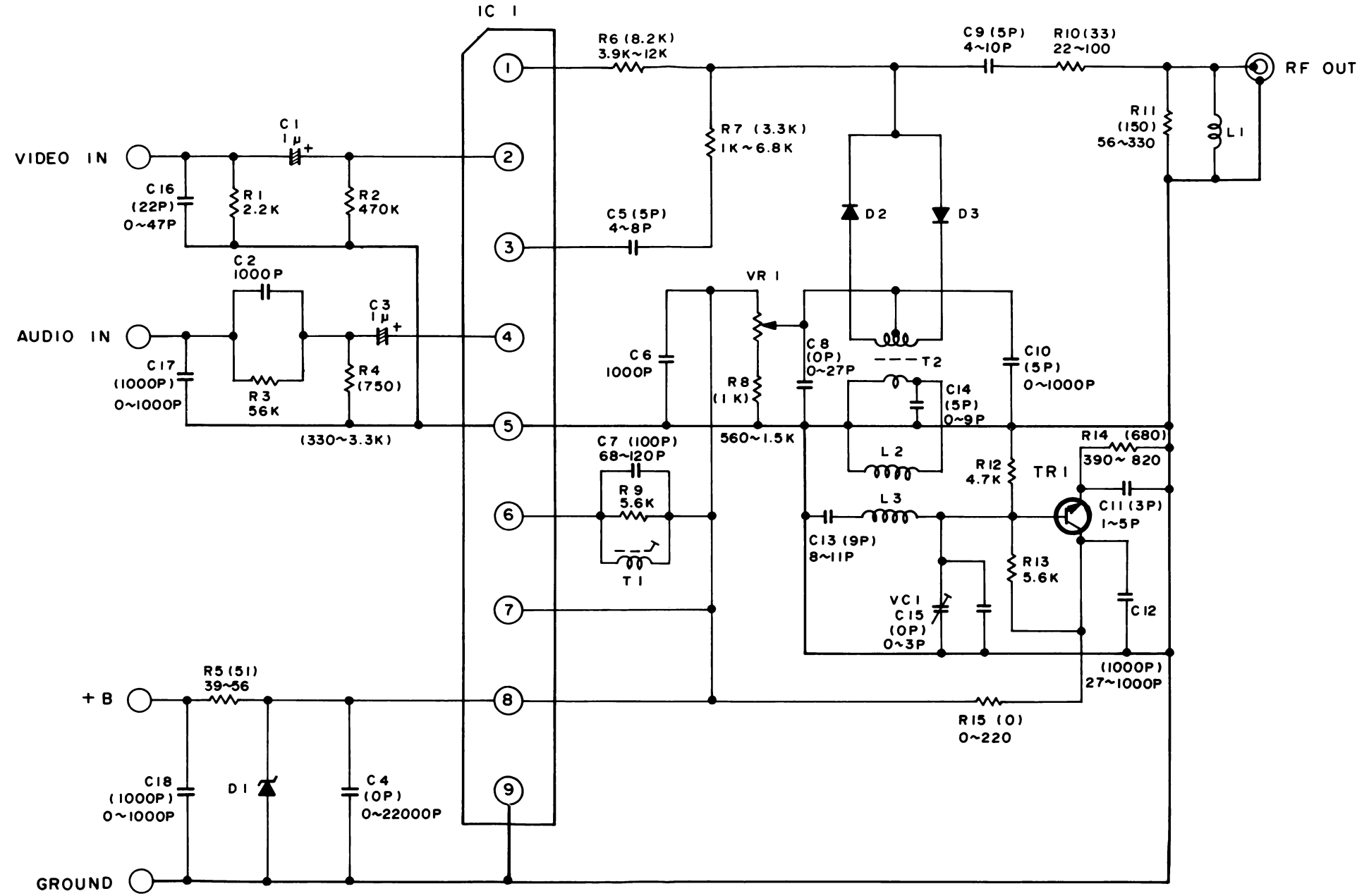
C14 CH1 RESO R1 CH1 Q R2 CH2 Q C13 CH2 RESO



— OSC —







SECTION 5

EXPLODED VIEWS AND PARTS LIST

SAFETY PRECAUTION

Parts identified by the $\triangle$ symbol are critical for safety. Replace only with apesified part numbers.

5.1 STANDARD PART NUMBER CODING (Screw coding)

Standard screw part numbers are as follows.

Type of screw
(in capital letters)

1

2

Shape of screw head
(in capital letters)

Shape of thread
(in capital letters)

3

4

Material
(in capital letters)

Nominal diameter
(in figures)

5

6

Length
(in figures)

7

8

Surface treatment
(in capital letters)

9

Type of screw (first digit)

S Normal screws

D Assembled machine screws (with plain and spring washers)

L " (with spring washer)

N " (with plain washer)

F Feather screws

G Washer head tapping screws

M Wood screws

Shape of screw head (second digit)

B Brazier head

D Binding head

H Oval countersunk head

P Pan head

R Round head

S Flat head

T Truss head

W Washer head (machine screws)

X Toothed head

Material (third digit)

S Steel

E Stainless steel

C Cast iron

U Copper

B Brass

P Phosphor bronze

N Nickel silver

Y Cast brass

A Aluminum

Z Zinc alloy

K Polycarbonate

Shape of thread (fourth digit)

P Cross recessed head screws

(-) Slotted head machine screws

X Slotted-cross recessed head machine screws

K Cross recessed head machine screws for precision equipment (type 1)

H " (type 3)

A Cross recessed head tapping screws (type 1)

B " (type 2)

C " (type 3)

E Cross recessed head special tapping screws (brand : evertight)

F " (brand : P-tight)

T " (brand : taptight)

G " (brand : taptight)

Shape of thread (fourth digit)

Cross recessed head

Slotted head

Slotted-cross recessed head

P, (-), X, K, H

A

B

C

E

F

G

T

Nominal diameter (fifth and sixth digits)

The fifth and sixth digits are numbers indicating a nominal diameter or dimension. If the dimension exceeds 10 mm, three digits are used. The number indicates a nominal diameter or dimension, given in millimeters, multiplied by ten.

Surface treatment (ninth digit)

Z Dichromate treatment after galvanizing (MFZn II-C)

N Nickel plating (MFNi II, MFNi I)

R Chromium plating (MBCr II, MBCr I)

G Silver plating (SP4)

B Black coating after plating

F Blackening of iron (FB)

M Blackening after galvanizing

K Pickling of brass (PF2)

P Phosphate treatment

W Uni-chrome plating

L Coating with transparent paint

A Coloring red after galvanizing (MFZn II-C)

C Coloring blue after galvanizing (MFZn II-C)

T Coloring green after galvanizing (MFZn II-C)

V Coloring purple after galvanizing (MFZn II-C)

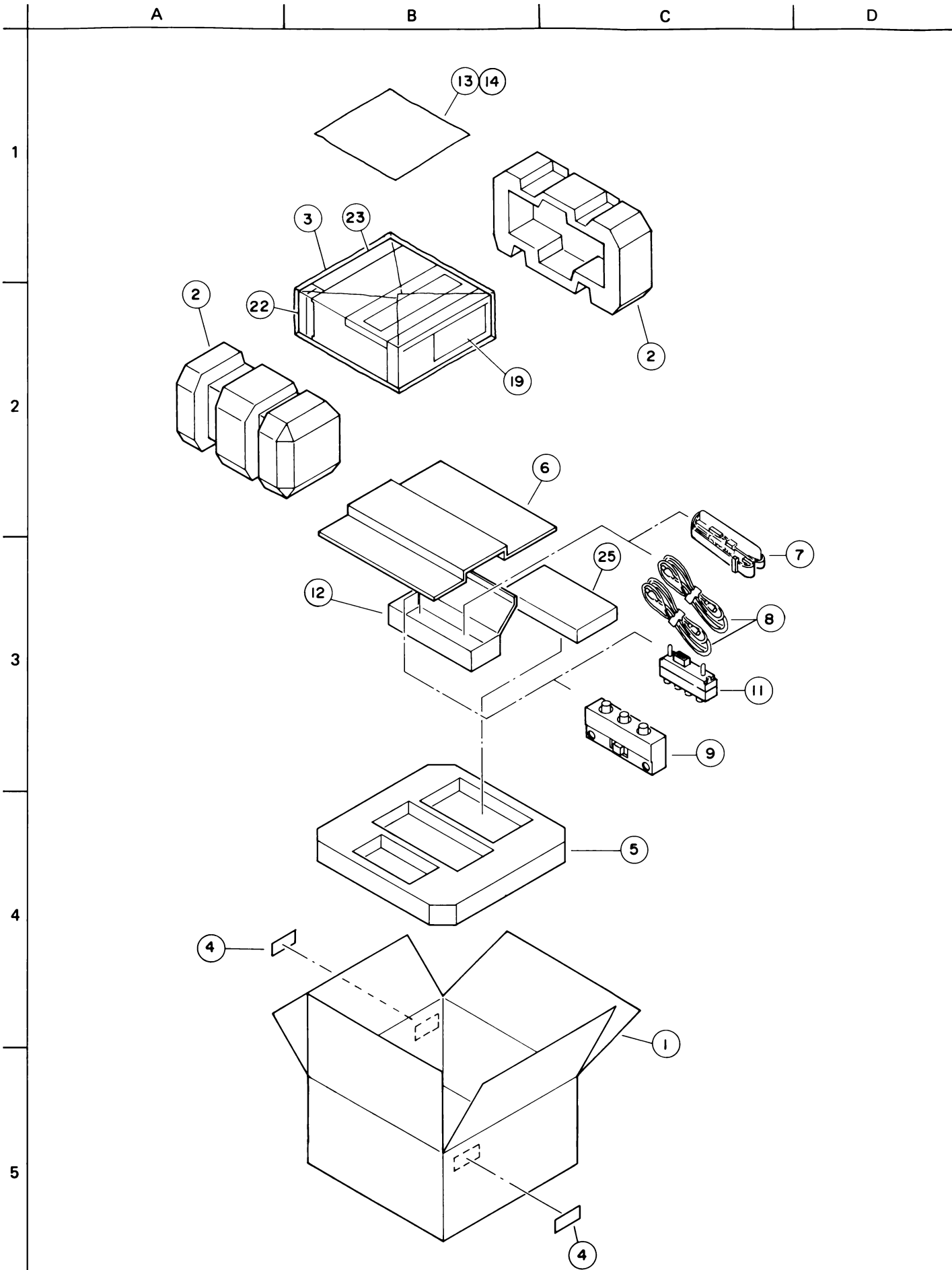
Length (seventh and eighth digits)

The seventh and eighth digits are numbers indicating length in millimeters. The preceding figure is zero when the dimension is smaller than 10 mm. For machine screws used in precision equipment whose length is given in units of 0.1 mm, the number indicates ten times the size of their length.

5-1

5.2 EXPLODED VIEWS AND PARTS LIST

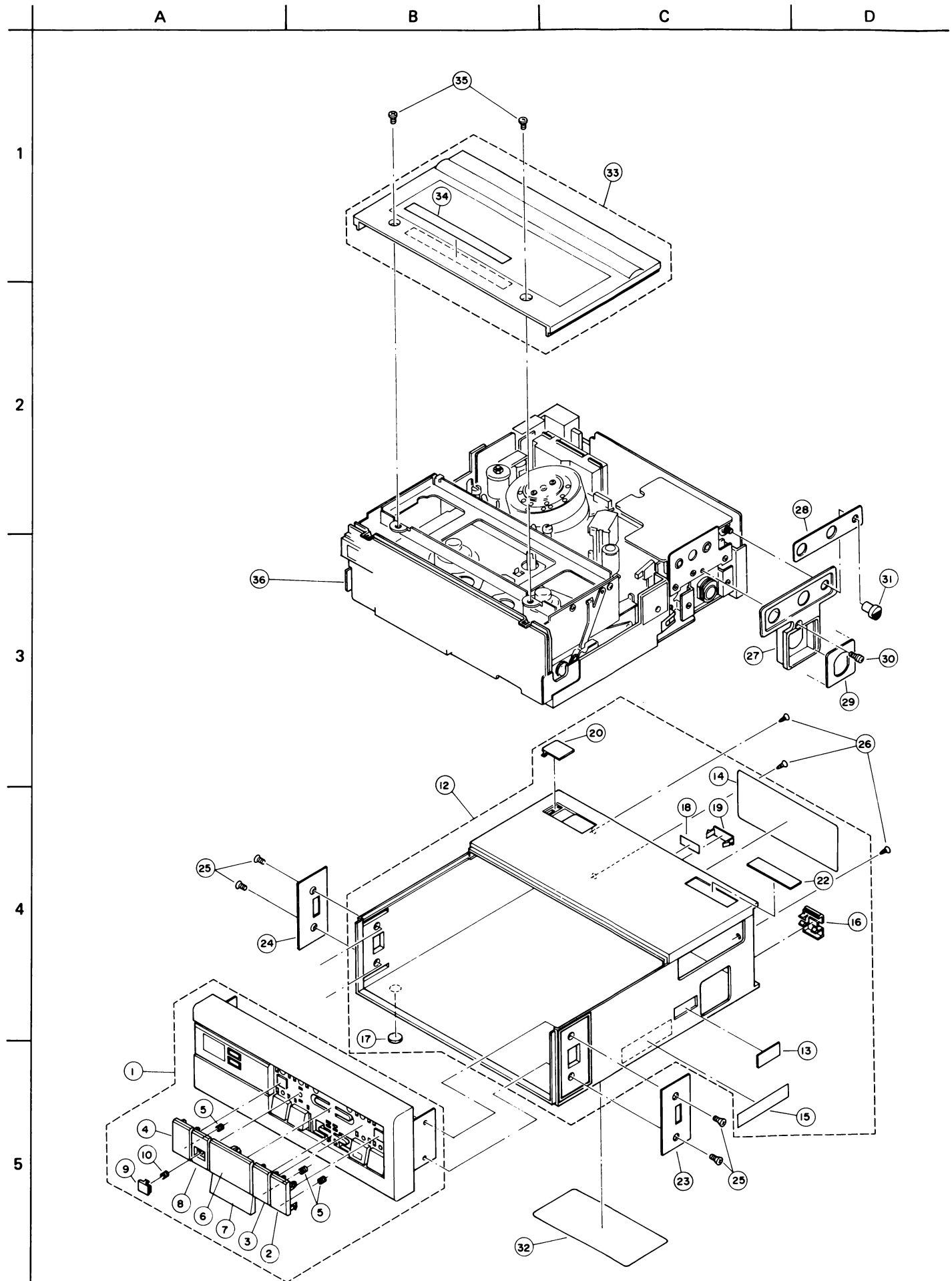
5.2.1 Packing assembly



— Packing assembly list —

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
1	PQ30257-6	Packing Case		4-C	1
2	PQ30258A	Cushion Ass'y		2-A, 2-C	1
3	PQM30021-42	Poly Bag		1-B	1
4	PUP40329	Serial No. Sticker		4-A	2
5	PQ30316	Cushion		4-C, 5-C	1
6	PQ30317	Sheet		2-C	1
7	PU56610-2	Shoulder Belt		3-D	1
△ 8	PU55906	AERIAL Cable Ass'y		3-C	2
9	PU53593-3	Antenna Select Box		3-C	1
10	—	—		—	—
11	PU56881-5	Dubbing Connector		3-C	1
12	PQ41014	Case		3-B	1
△ 13	PU30425-687	Instructions		1-B	1
14	QPGA025-03505	Poly Bag		1-B	1
15	—	—		—	—
16	—	—		—	—
17	—	—		—	—
18	—	—		—	—
19	—	Cabinet Ass'y	See Section 5.2.3.	2-B	1
20	—	—		—	—
21	—	—		—	—
22	PU57109-2	Connector Cover		2-A	1
23	PU21935B	Dummy Battery		1-B	1
24	—	—		—	—
25	PTE-30	Cassette Tape		3-C	1

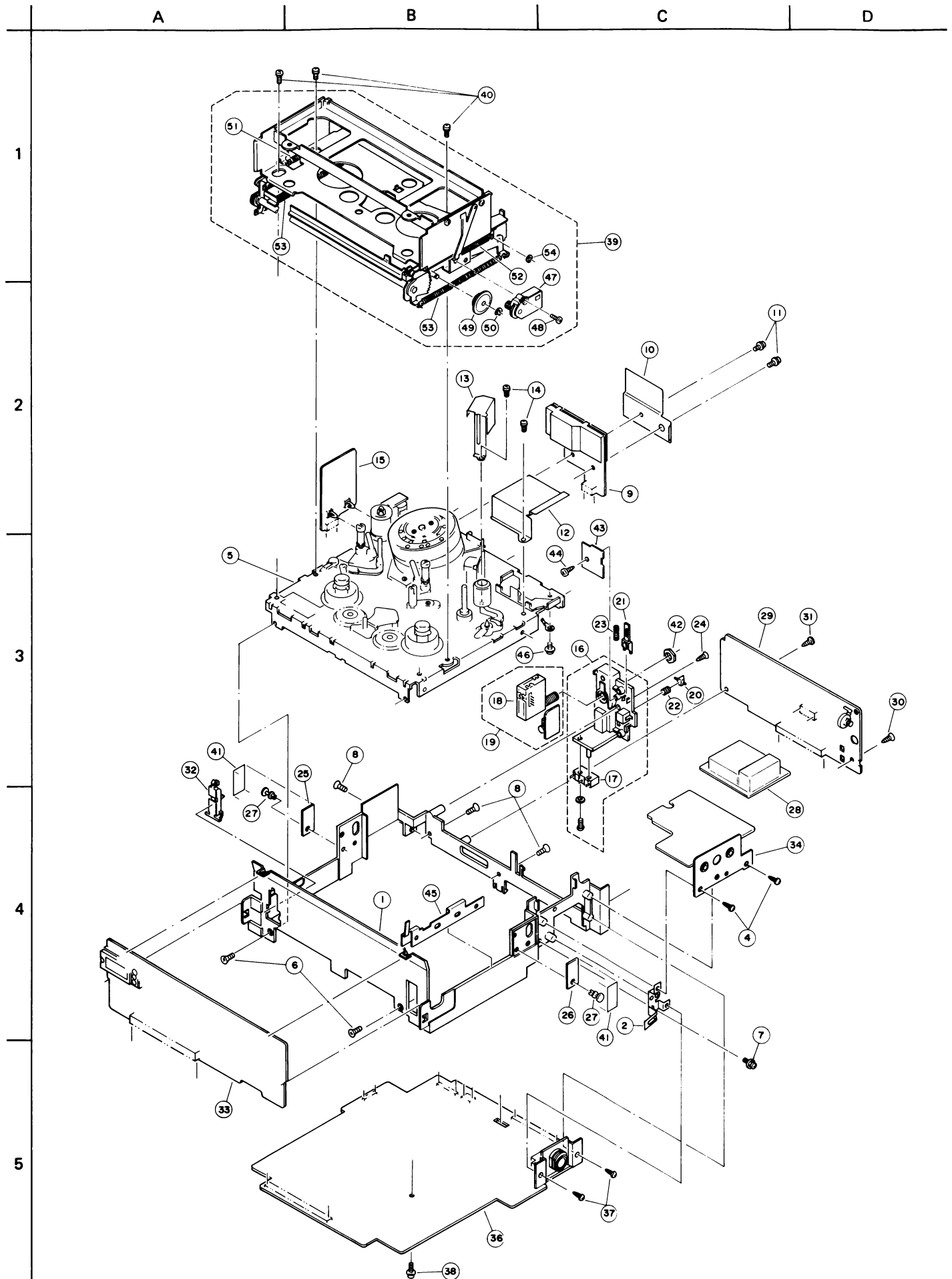
5.2.2 Cabinet assembly



— Cabinet assembly list —

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
⚠ 1	PQ10062J-6	Front Cover Ass'y	Incl. ② – ⑩	5-A	1
⚠ 2	PQ30248-4-4	Operation Button	EJECT	5-A	1
3	" -5-4	"	STOP	5-A	1
4	" -6-4	"	PAUSE	5-A	1
5	PQM30002-115	C. Spring	for ② x1, ③ x1, ④ x1	5-A, 5-B	3
6	PQ30250-2-2	Operation Button	REV/PLAY	5-A	1
7	PQ30251-2	"	REW/FF	5-A	1
8	PQ30260	Sub Button		5-A	1
9	PQ40796-2-2	Operation Button	REC	5-A	1
10	PQM30002-122	C. Spring	for ⑨	5-A	1
⚠ 11	—	—		—	—
⚠ 12	PQ10064K-9	Bottom Cover Ass'y	Incl. ⑬ – ⑳	4-B	1
13	PQ30310-10-4	Camera Connector Label		5-D	1
14	PQ30288-8-4	Battery Caution Label		3-C	1
15	PU47385	Caution Label		5-D	1
16	PQ30261-1-2	Terminal Cover		4-D	1
17	PQ40782	Foot		4-B	4
18	PQ30311-5	V. Lock Label		4-C	1
19	PQ40974-5-2	Cap	V-Position	4-C	1
20	PQ40781-10-3	"	RF	3-C	1
⚠ 21	—	—		—	—
⚠ 22	PQM30022-14	Mark		4-D	1
⚠ 23	PQ40778-1-3	Side Plate (R)		5-C	1
⚠ 24	PQ40777-1-3	" (L)		4-A	1
25	SSSP3006R	Screw		4-A, 5-C	4
⚠ 26	SSSF3010M	Tap. Screw		3-D	3
⚠ 27	PQ30254	Connector Cover		3-C	1
28	PQ30255-2-1	Connector Plate		2-D	1
29	PQ40983	Insulator		3-D	1
30	SDSP2606Z	Screw		3-D	1
⚠ 31	PQ40775	Knob	TRACKING	3-D	1
⚠ 32	PQ30256-12	Rating Label		5-B	1
⚠ 33	PQ20110J-2	Cassette Cover Ass'y	Incl. ⑳	1-C	1
34	PU35241-4	Label		1-B	1
35	SDSP3006M	Screw		1-B	2
36	—	Chassis Ass'y	See Section 5.2.4	3-A	1

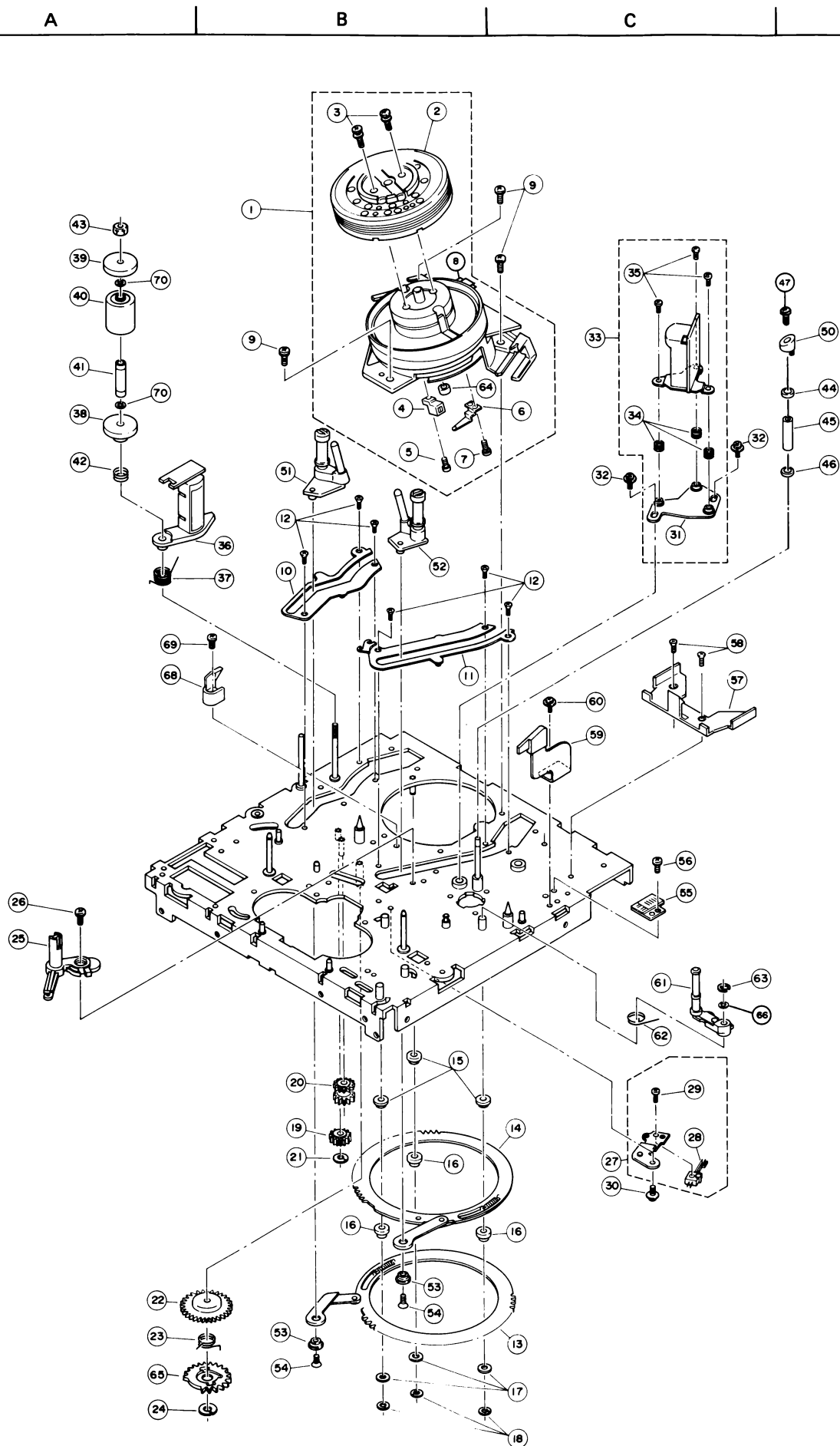
5.2.3 Chassis assembly



— Chassis assembly list —

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
1	PQ10060-1-3	Frame		4-B	1
2	PQ41002	Earth Lug		4-C	1
3	—	—		—	—
4	SDSA3008Z	Tap. Screw		4-C	2
5	—	Mechanism Ass'y	See Section 5.2.5 and 5.2.6.	3-A	1
6	SSSP3012Z	Screw		4-B	2
7	DPSP3012Z	"		4-C	1
8	SSSP3006Z	"		3-B	3
9	—	Pre-amp Board Ass'y	See Section 6.2.5.	2-C	1
10	PU57112A	Shield Plate Ass'y		2-C	1
11	DPSP2006Z	Screw		2-C	2
12	PQ30340A	Shield Plate Ass'y		3-C	1
13	PQ30247-1-3	Shield Cover		2-B	1
14	LPSP2604Z	Screw		2-B	2
15	—	OSC Board Ass'y	See Section 6.2.7.	2-B	1
16	PU56562-2-2	Multi Connector	Incl. (17)	3-C	1
17	PU56858	Micro Switch		3-C	1
△ 18	PU57495	RF Converter		3-B	1
△ 19	PU56564B	Converter Board Ass'y	Incl. (18)	3-B	1
20	PQ40773	Battery Stopper		3-C	1
21	PQ40774	Slider		3-C	1
22	PQM30002-113	C. Spring		3-C	1
23	" -114	"		3-C	1
24	SSSA3010Z	Tap. Screw		3-C	1
25	PU57033A-1	E. Sensor Board Ass'y		3-B	1
26	PU57034A-1	S. Sensor Board Ass'y		4-C	1
27	PU56800	Nylon Rivet		4-A, 4-C	2
28	—	MDA Board Ass'y	See Section 6.2.4.	4-D	1
29	—	Servo Board Ass'y	See Section 6.2.3.	3-C	1
30	SSSA2608M	Tap. Screw		3-D	1
31	SDSA2608Z	"		3-D	1
32	PU56571	Leaf Switch	REC Safety	3-A	1
33	—	Mechacon Board Ass'y	See Section 6.2.1.	5-A	1
34	—	Audio Board Ass'y	See Section 6.2.6.	4-D	1
35	—	—		—	—
36	—	Video Board Ass'y	See Section 6.2.2.	5-B	1
37	SDSA3008Z	Tap. Screw		5-C	2
38	DPSP2606Z	Screw		5-B	1
39	PUS27210C	C. Housing Ass'y	Incl. (47) — (54)	1-C	1
40	LPSP3004Z	Screw		1-B	3
41	PQ41253	Sheet		3-A, 4-C	2
42	PQ41256	Nut		3-C	1
43	PQ41072	Stop Plate		2-C	1
44	SDSA2606Z	Screw		3-C	1
45	PQ41137	Earth Plate		4-B	1
46	DPSP3004Z	Screw		3-B	1
47	PU56781	Damper		1-C	1
48	SPSP2006Z	Screw		2-C	1
49	PQ41036	Damper Gear		2-B	1
50	REE1500	E-Ring		2-B	1
51	PQM30001-166	T. Spring		1-A	1
52	" -167	"		1-B	1
53	" -177	"		2-B	2
54	PQM30017-1	Slit Washer		1-C	1

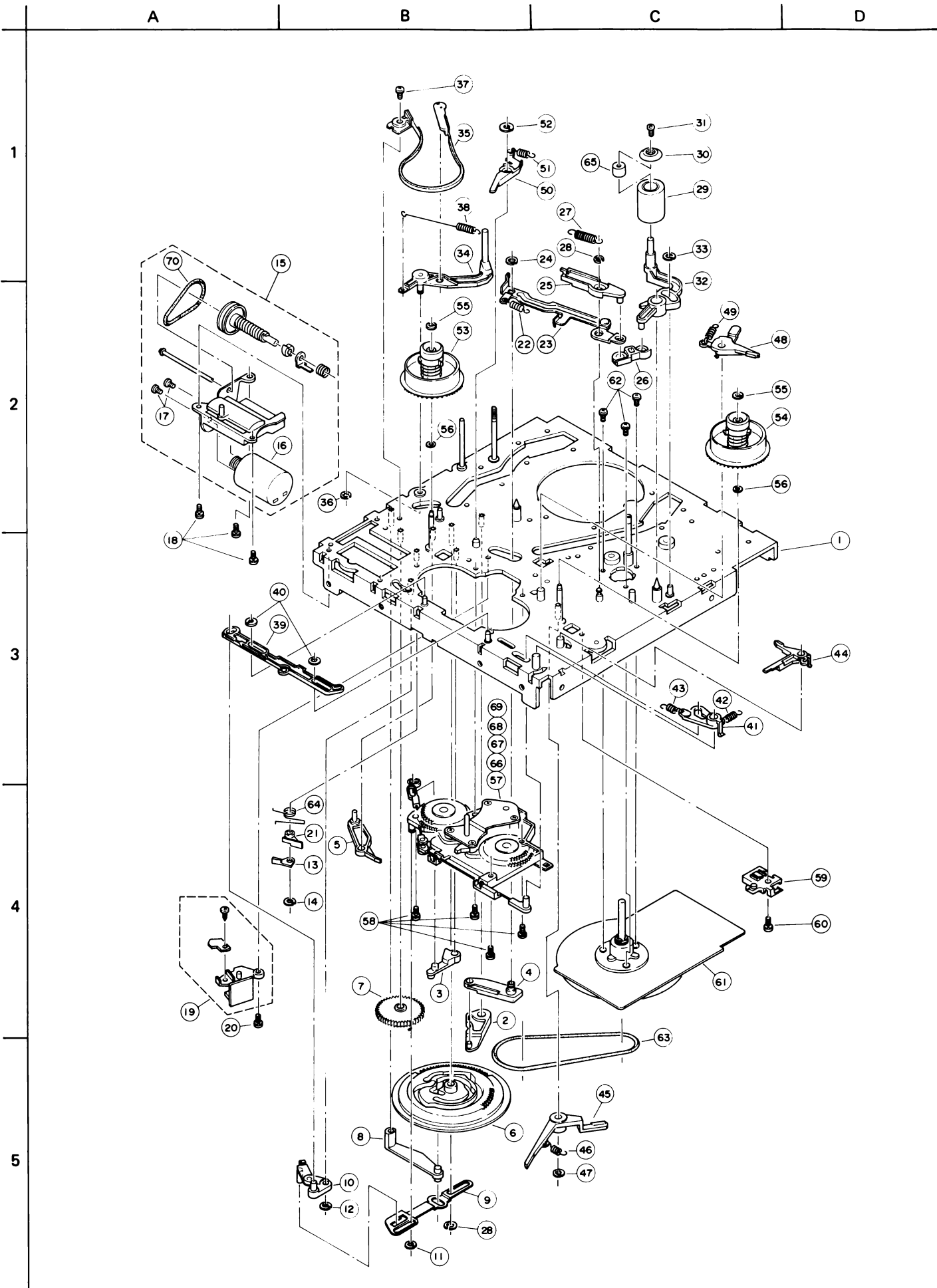
5.2.4 Mechanism assembly (1)



— Mechanism assembly (1) list —

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
△ 1	PUS36729G	Drum Ass'y	Incl. ② – ⑧ and ⑥4	1-B	1
2	PQ20016A-2	Upper Drum Ass'y		1-B	1
3	NDBP2608N	Screw		1-B	2
4	PQ40352B-2	PU Head Ass'y		2-B	1
5	SPSH1735Z	Mini Screw		2-B	1
6	PU56798-3	Brush Ass'y	or PU56202-4	2-B	1
7	LPSP2003Z	Screw		2-B	1
8	PU56202-2	Heater		1-B	1
9	LPSP2608Z	Screw		1-C, 2-B	3
10	PQ30264	Guide Rail (SUP)		2-B	1
11	PQ30265	" (TU)		3-B	1
12	PQ41269-2	Screw		2-B, 2-C	6
13	PQ40812A-1	Loading Ring Ass'y (SUP)		5-C	1
14	PQ40816A-1	" (TU)		4-C	1
15	PQ40819-1-2	Guide Roller (1)		4-B	3
16	PQ40820-1-2	" (2)		4-B, 5-B, C	3
17	PQM30005-40	Collar		5-C	3
18	PQM30017-22	Slit Washer		5-C	3
19	PQ40822	Connect Gear (1)		4-B	1
20	PQ40823	" (2)		4-B	1
21	PQM30017-24	Slit Washer		4-B	1
22	PQ30336	Loading Gear (1)		5-A	1
23	PQ41069	Torsion Spring		5-A	1
24	PQM30017-18	Slit Washer		5-A	1
25	PUS36752A	Cassette LED Ass'y		4-A	1
26	LPSP2606Z	Screw	Incl. ⑳ and ㉑	3-A	1
27	PUS46515C	AL SW Ass'y		4-C	1
28	PU56659	AL SW		4-C	1
29	SPSP2007Z	Screw		4-C	1
30	DPSP2604Z	"		4-C	1
31	PQ40877A	Head Base Ass'y		2-C	1
32	DPSP3007	Screw		2-C	2
33	PUS46521A	A/C Head Ass'y		2-C	1
34	PU30080-49	C. Spring		2-C	3
35	SPSP2608Z	Screw		1-C	3
36	PQ40865A	FE Head Ass'y		2-B	1
37	PQ40871	Torsion Spring		2-B	1
38	PQ41216	Lower Flange		2-A	1
39	PQ40868-2	Upper Flange		1-A	1
40	PQ41192A	Roller Ass'y		1-A	1
41	PQ41217	Collar		2-A	1
42	PQM30002-124	C. Spring		2-A	1
43	NTS3000ZS	Nut		1-A	1
44	PQ40268-2	Guide Flange		2-D	1
45	PU53629-2	Tape Guide (Guide Pole)		2-D	1
46	PQ41348-2	Guide Flange		2-D	1
47	SDSP2006Z	Screw		1-D	1
48	—	—		—	—
49	—	—		—	—
50	PQ41346	G. Pole Cap		2-D	1
51	PQ40357B-1	Pole Base Ass'y (SUP)		2-B	1
52	PQ40354E-3	" (TU)		2-B	1
53	PQ40872	Spacer		5-B	2
54	PQ41269	Special Screw		5-B	2
55	PU56637B	Dew Sensor Ass'y		3-C	1
56	LPSP2604Z	Screw		3-C	1
57	PQ40875	Board Holder		3-C	1
58	SSSP2605Z	Screw		3-C	2
59	PQ40873A	Door Guide Ass'y		3-C	1
60	DPSP2605Z	Screw		3-C	1
61	PQ40993A-6	TU Guide Ass'y		4-C	1
62	PQ40994-1-2	Torsion Spring		4-C	1
63	REE2500	E-Ring		4-C	1
64	PU49483-2	Commutator		2-C	1
65	PQ30337	Loading Gear (2)		5-A	1
66	PQM30018-33	Washer		4-C	1
67	—	—		—	—
68	PQ41138	Stopper		3-A	1
69	LPSP2606Z	Screw		3-A	1
70	QO3093-819	Washer		2-A	2

5.2.5 Mechanism assembly (2)



— Mechanism assembly (2) list —

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
1	PQ10076B	Main Deck Ass'y		3-D	1
2	PQ40826	Cam Lever (1)		4-B	1
3	PQ40827	" (2)		4-B	1
4	PQ40828A	Relay Arm Ass'y		4-B	1
5	PQ40831A	Cancel Lever Ass'y		4-B	1
6	PQ20064-1-7	Control Cam		5-B	1
7	PQ40833	Worm Wheel		4-B	1
8	PQ40834A	Cam Lever (3) Ass'y		5-B	1
9	PQ40836-1-2	Slide Plate		5-B	1
10	PQ40837A-3	Relay Lever Ass'y		5-B	1
11	PQM30017-22	Slit Washer		5-B	1
12	" -23	"		5-B	1
13	PQ41225-1-2	Cam Brake		4-A	1
14	PQM30017-23	Slit Washer		4-A	1
△ 15	PU56641A-6	Motor Bracket Ass'y	Incl. (16) and (17)	1-B	1
△ 16	PU56592V-1	Motor Ass'y (Mode Control)		2-A	1
17	SPSP2004Z	Screw		2-A	2
18	LPSP2605Z	"		3-A	3
19	PUS46513C	Mode Sensor Board Ass'y		4-A	1
20	LPSP2606Z	Screw		4-A	1
21	PQ41226	Cam Brake 2		4-A	1
22	PQM30001-153	Spring		2-B	1
23	PQ30267B	P.R. Plate Ass'y	Incl. (22)	2-C	1
24	PQM30017-23	Slit Washer		1-C	1
25	PQ40843	Toggle Arm (1)		2-C	1
26	PQ40844	" (2)		2-C	1
27	PQ41124-1-1	T. Spring		1-C	1
28	REE2500	E-Ring		1-C	1
29	PQ41125A	Pinch Roller Ass'y		1-C	1
30	PU53878	P.R. Cap		1-C	1
31	SPSP2005Z	Screw		1-C	1
32	PQ40845A-2	P.R. Arm Sub Ass'y		2-C	1
33	PQM30017-22	Slit Washer		1-C	1
34	PQ40848B	Tension Pole Ass'y		1-B	1
35	PQ40851A	Tension Band Ass'y		1-B	1
36	REE2000	E-Ring		2-B	1
37	LPSP2606Z	Screw		1-B	1
38	PQ40855-1-3	T. Spring		1-B	1
39	PQ30269-1-3	Control Plate		3-A	1
40	PQM30017-22	Slit Washer		3-A	2
41	PQ40856A	Eject Lever Ass'y	Incl. (42) and (43)	3-C	1
42	PQM30001-156	T. Spring		3-C	1
43	" -157	"		3-C	1
44	PQ40858B	Search Brake Ass'y		3-D	1
45	PQ30270A-1	Capstan Brake Ass'y	Incl. (46)	5-C	1
46	PQM30001-158	T. Spring		5-C	1
47	PQM30017-23	Slit Washer		5-C	1
48	PQ40860A-2	REW Brake Ass'y	Incl. (49)	2-C	1
49	PQM30001-159-5	T. Spring		2-C	1
50	PQ40862A-2	FF Brake Ass'y	Incl. (51)	1-C	1
51	PQM30001-160-5	T. Spring		1-C	1
52	PQM30017-24	Slit Washer		1-C	1
53	PU57581	Reel Disk (TU)		2-B	1
54	PU57580	" (SUP)		2-C	1
55	PQM30017-22	Slit Washer		2-C	2
56	Q03093-827	Washer		2-C	2
57	PU56647A-5	Clutch Mechanism Ass'y	Incl. (66) – (69)	3-B	1
58	LPSP2608Z	Screw		4-B	4
59	PUS46514B	TU Sensor Board Ass'y		4-D	1
60	LPSP2606Z	Screw		4-D	1
△ 61	PU56660V	Capstan Motor		4-C	1
62	LPSP2605Z	Screw		2-C	3
63	PQM30003-12	Belt (Reel)		5-C	1
64	PQ41252-2	Torsion Spring		4-A	1
65	PQM30005-39	Collar		1-C	1
66	PU56650-1-2	Clutch (TU)		3-B	1
67	PU56651-1-2	" (SUP)		3-B	1
68	Q03093-827	Washer	for Clutch	3-B	3
69	PQM30017-2	Slit Washer	for Clutch	3-B	3
70	PQM30003-15	Belt	for Mode Control Motor	1-A	1

SECTION 6

ELECTRICAL PARTS LIST

SAFETY PRECAUTION

Parts identified by the $\triangle$ symbol are critical for safety. Replace only with specified part numbers.

ABBREVIATIONS IN THIS LIST ARE AS FOLLOWS:

RESISTORS -- All resistance values are in ohms (Ω).

K	1 000
M	1 000 000
CR	: Carbon Resistor
Comp. R:	Composition Resistor
WR	Wire Wound Resistor
OMR	Oxide Metal Film Resistor
VR	Variable Resistor (Potentiometer)
MFR	Metal Film Resistor
FR	Fusible Resistor
PMR	Precision Metal Film Resistor

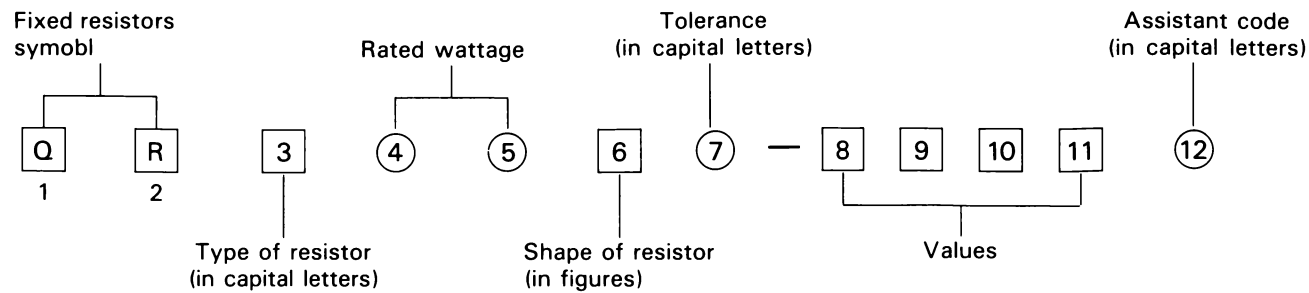
CAPACITORS -- All capacitance values are in μF , unless otherwise indicated.

P	$\mu\mu\text{F}$
C Cap	Ceramic Capacitor
E Cap	Electrolytic Capacitor
FM Cap :	Film Mica Capacitor
MM Cap :	Metalized Mylar Capacitor
MP Cap	Metalized Paper Capacitor
MY Cap :	Mylar Capacitor
NP Cap	Non-polar Capacitor
PC Cap	Polycarbonate Capacitor
PP Cap	Poly Pro Capacitor
PS Cap	Polystyrol Capacitor
T Cap	Tantalum Capacitor
TR Cap :	Trimmer Capacitor
LL Cap :	Low Leak Current Electrolytic Capacitor
TF Cap :	Thin Film Capacitor

6.1 STANDARD PART NUMBER CODING

6.1.1 Fixed resistor coding

Fixed resistor part numbers are as follows.



Type of resistor (third digit)	Rated wattage (fourth and fifth digits)	Tolerance (seventh digit)	Assistant code (twelfth digit)
C Composition resistors	A0 1/10 W	F ± 1 %	A Small type
D Carbon film resistors	18 1/8 W	G ± 2 %	B Small type
F Unflammable resistors	16 1/6 W	J ± 5 %	S Small type
G Oxide metal film resistors	14 1/4 W	K ± 10 %	Y Lead taping
H Fusible resistors	12 1/2 W	M ± 20 %	Z Lead taping
M Metal plate resistors	01 1 W		
S Metal glazed resistors	02 2 W		
V Precision metal film resistors	03 3 W		
W Wire wound resistors	04 4 W		
X Metal film resistors	05 5 W		
Z Special resistors	06 6 W		
	07 7 W		
	75 7.5 W		
	08 8 W		
	10 10 W		
	15 15 W		
	A6 16 W		
	20 20 W		
	30 30 W		

Values (eighth – tenth or eleventh digits)
examples:

R47		0.47 Ω
4R7		4.7 Ω
470	 47 × 10 ⁰	47 Ω
471	 47 × 10 ¹	470 Ω
472	 47 × 10 ²	4.7 kΩ
473	 47 × 10 ³	47 kΩ
474	 47 × 10 ⁴	470 kΩ
475	 47 × 10 ⁵	4.7 MΩ

ORV resistance shown by four digits:

4640	 464 × 10 ⁰	464 Ω
4641	 464 × 10 ¹	4.64 kΩ
4642	 464 × 10 ²	46.4 kΩ

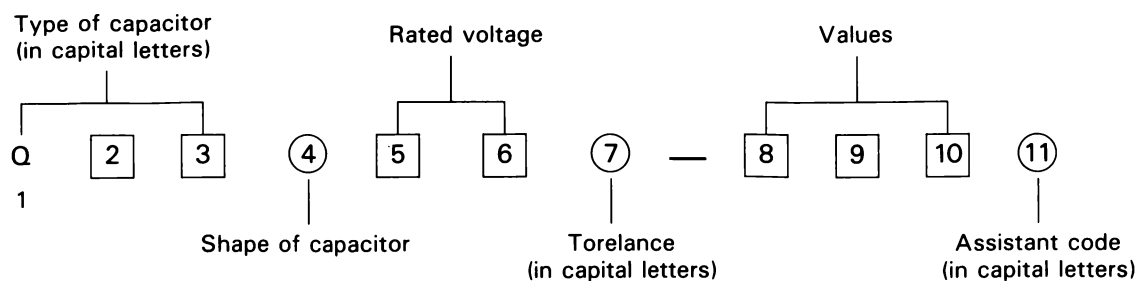
Shape of resistor (sixth digit)

Note: ■ marks are flame retardant resistor.

Type of resistor Shape of resistor	C	D	F	G	H	M	S	V	W	X
1										
2										
3										
4										
5									(L) type	
6										
7			Lug (B) type							
8			Lug (A) type							
9			Lug (C) type				Chip			

6.1.2 Fixed capacitor coding

Fixed capacitor part numbers are as follows.



Ceramic capacitors

Type of capacitor (first – third digits)		Shape of capacitor (fourth digit)				
Symbol	Characteristics	Mono-direction	Kink lead	Axial lead	Axial forming lead	Chip
QCC	Ceramic	1		4	5	
QCD	High capacitance					A
QCF	High capacitance	1,4	3			8,A
QCS	Temperature compensation	1	3	4	5	8,A
QCT	Temperature compensation	Special coding				
QCV	Ceramic			1	3	
QCX	Ceramic			1	3	
QCY	High capacitance	1,4	3	6	7	8,A
QCZ	Special type	Special coding				

Electrolytic capacitors

Type of capacitor (first-third digits)		Shape of capacitor (fourth digit)				
Symbol	Characteristics	Tubular	Mono-direction	Anti-stress	Forming	Snap-in
QEB	Low leakage		4	5	6	
QEC	Low leakage		4,8,A	9,B	6,C	
QEE	Tantalum (normal)		4	5	6	
	Tantalum (small)		8			
QEF	Chip tantalum	8 (chip type)				
QEG	Low impedance		4			
QEK	Miniature type		4	5	6	
QEL	Small type		4	5	6	7
QEM	Small type		4	5	6	
QEN	Non-polar	2	4	5	6	
QEP	Non-polar (small)		4,A	5,B	6,C	
QER	Miniature type		4	5	6	
QET	Small type	2	4	5,B	6,C	7
QEU	Small type		4	5	6	
QEV	Small type		4		6	7
QEW	Normal	2	4	5	6	7

Paper film capacitors

Type of capacitor (first — third digits)		Shape of capacitor (fourth digit)				
		Tubular	Normal		Flame retardant	
Symbol	Characteristics		Mono-direction	Kink lead	Mono-direction	Kink lead
QFA	Metalized polypropylene				7	
QFE	Metalized mylar				5	
QFF	Film mica		4			
QFG	Polypropylene film		4	8		
QFH	Metalized mylar	2	4	3	5,7	6
QFJ	Mylar (special)		4			
QFK	Metalized mylar (small)				5	
QFM	Mylar	2	4	3,7	5	6
QFN	Mylar (small)		4	3		
QFP	Polypropylene		4	3,8		
QFS	Polystyrole	2	4	3		
QFV	Thin film		4	8		
QFZ	Special type	Special coding				

Rated voltage (fifth and sixth digits)

Fifth digit \ Sixth digit													
	A	B	C	D	E	F	G	H	J	K	V	W	X
0						3.15	4.0		6.3				
1	10		16	20	25		40	50	63	80	35		
2	100	125	160	200	250	315	400	500	630		350	450	600
3	1000	1250		2000				5000					

Tolerance (seventh digit)

A	+100 % -10 %	M	±20 %
F	±1 %	N	±30 %
G	±2 %	P	+100 % -0 %
H	+50 % -10 %	R	+30 % -10 %
J	±5 %	X	+40 % -20 %
K	±10 %	Z	+80 % -20 %

Values (eighth — tenth digits)

Example : Values are in picofarads

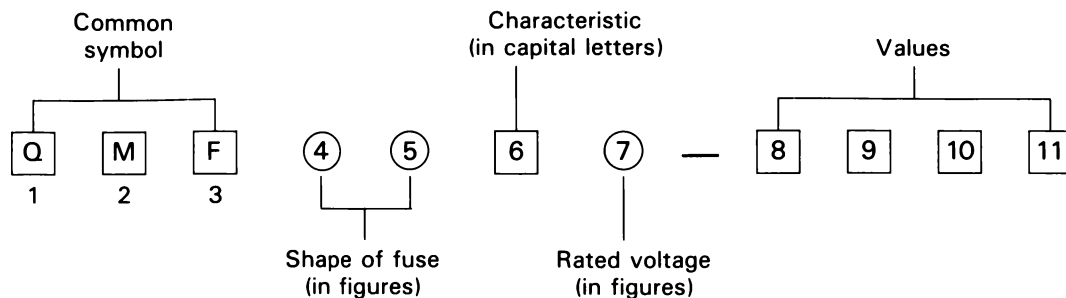
101	 10×10^1 pF	100 pF
102	 10×10^2 pF	1,000 pF (0.001 μ F)
103	 10×10^3 pF	10,000 pF (0.01 μ F)
104	 10×10^4 pF	100,000 pF (0.1 μ F)
105	 10×10^5 pF	1 μ F
5R0		5.0 pF

Assistant code (eleventh digit)

G	Small size
Z	Lead tapping

6.1.3 Fuse coding

Standard fuse part numbers are as follows.



Shape of fuse (fourth and fifth digits)

51	φ5.2 × 20 mm
60	φ6.4 × 30 mm
61	φ6.35 × 31.8 mm
63	φ6.4 × 30 mm with lead wires
66	φ6.35 × 31.8 mm with lead wires
00	Special type

Rated voltage (seventh digit)

1	AC125 V
2	AC250 V
3	0.1 – 1 A : AC250 V 1.25 – 6.3 A : AC125 V

Values (eighth-tenth or eleventh digits)

example:

R63	 0.63 A
1R0	 1.0 A
2R5	 2.5 A
100	 10 A
R315	 0.315 A
1R25	 1.25 A

Characteristics (sixth digit)

Symbol	Fusing Current	Fusing Time	Remarks
A	210 %	Within 2 min.	Anti-rush type (for Europe)
	275 %	0.6 – 10 sec.	
	400 %	0.15 – 3 sec.	
	1000 %	0.02 – 0.3 sec.	
B	210 %	Within 30 min.	Regular fusible type (for SEMKO, Europe)
	275 %	0.05 – 2 sec.	
	400 %	0.01 – 0.3 sec.	
C	135 %	Within 1 hr.	Regular fusible type (for UL, Japan)
	200 %	Within 2 min.	
E	210 %	Within 2 min.	Anti-rush type (for Europe)
	275 %	0.6 – 10 sec.	
	400 %	0.15 – 3 sec.	
	1000 %	0.02 – 0.3 sec.	
J	135 %	Within 1 hr.	Anti-rush type
	200 %	Within 2 min.	
M	135 %	Within 1 hr.	Regular fusible type (for UL)
	200 %	Within 2 min.	
R	160 %	Within 1 hr.	Regular fusible type
	200 %	Within 2 min.	
S	160 %	Within 1 hr.	Anti-rush type
	200 %	Within 2 min.	
	700 % – 2000 %	Within 0.01 sec.	
U	135 %	Within 1 hr.	Anti-rush type (for UL)
	200 %	Within 2 min.	
	800 % – 2000 %	Within 0.01 sec.	

6.2 ELECTRICAL PARTS LIST BY ASSEMBLIES

6.2.1 Mechacon board ass'y 01 PU21823B-9

Symbol No.	Part No.	Part Name	Description
IC 1	HD6305X0A32P	CPU	Op-amp
IC 2	S-81250HG	Reg. Transistor	
IC 3	IR3702	Integrated Circuit	
IC 4	BA728	"	
IC 5	BA6109U3	"	
Q 1	DTA114ES	D. Transistor	
Q 2	2SC3399	"	
Q 3	2SA1346	"	
Q 4	2SC3400	"	
Q 5	"	"	
Q 6	2SA1175	Transistor	D. Transistor
Q 7	2SC3400	D. Transistor	
Q 8	"	"	
Q 9	"	"	
Q10	2SA1346	"	
Q11	"	"	
Q12	"	"	
Q13	"	"	
Q14	2SC3400	"	
Q15	"	"	
Q16	"	"	—
Q17	—	—	
Q18	2SC3400	D. Transistor	
Q19	"	"	
Q20	"	"	
Q21	"	"	
Q22	"	"	
Q23	"	"	
Q24	"	"	
Q25	"	"	
Q26	"	"	
Q27	"	"	
Q28	"	"	
Q29	—	—	
Q30	2SC3400	D. Transistor	
Q31	"	"	
Q32	2SA1346	"	
Q33	"	"	
Q34	"	"	
Q35	"	"	
Q36	"	"	
Q37	"	"	
Q38	2SC3400	"	
Q39	"	"	
Q40	—	—	
Q41	2SC3400	D. Transistor	
Q42	"	"	
Q43	N13T1	PUT	
Q44	DTC144WF	D. Transistor	
D 1	RD5.1EB1	Zener Diode	
D 2	1SS133	Diode	
D 3	"	"	
D 4	"	"	
D 5	RD3.3EB1	Zener Diode	

Symbol No.	Part No.	Part Name	Description
D 6	1SS133	Diode	
D 7	"	"	
D 8	—	—	
D 9	—	—	
D10	—	—	
D11	1SS133	Diode	
D12	"	"	
D13	"	"	
D14	RD12EB1	Zener Diode	
D15	RD8.2EB3	"	
D16	—	—	or HZ3A
D17	RD2.7EB1	Zener Diode	
LD 1	GL-3HD6	L.E.D.	STOP
LD 2	"	"	FF
LD 3	"	"	REW
LD 4	"	"	REV. PB
LD 5	"	"	PB
LD 6	"	"	STILL/PAUSE
LD 7	"	"	A. REC
LD 8	"	"	INST.
LD 9	"	"	REC
DA 1	DAN601	Diode Array	
DA 2	"	"	
DA 3	"	"	
DA 4	DAP20i	"	
DA 5	"	"	
DA 6	"	"	
DA 7	"	"	
DA 8	"	"	
DA 9	"	"	
DA10	"	"	
DA11	"	"	
R 1	QRD161J-333	CR	33 K 1/6 W
R 2	" -103	"	10 K "
R 3	" -333	"	33 K "
R 4	" -473	"	47 K "
R 5	" -102	"	1 K "
R 6	" -102	"	1 K "
R 7	" -223	"	22 K "
R 8	" -473	"	47 K "
R 9	" -472	"	4.7 K "
R10	" -102	"	1 K "
R11	" -222	"	2.2 K "
R12	" -472	"	4.7 K "
R13	" -104	"	100 K "
R14	" -333	"	33 K "
R15	" -332	"	3.3 K "
R16	" -562	"	5.6 K "
R17	" -473	"	47 K "
R18	" -223	"	22 K "
R19	" -471	"	470 "
R20	" -331	"	330 "

Symbol No.	Part No.	Part Name	Description
R21	QRD161J-331	CR	330 1/6 W
R22	" -471	"	470 "
R23	" -471	"	470 "
R24	" -393	"	39 K "
R25	" -391	"	390 "
R26	" -822	"	8.2 K "
R27	" -273	"	27 K "
R28	QVZ3531-103	VR	10 K
R29	QRD161J-153	CR	15 K 1/6 W
R30	" -223	"	22 K "
R31	" -394	"	390 K "
R32	" -104	"	100 K "
R33	" -564	"	560 K "
R34	—	—	
R35	QRD161J-104	CR	100 K 1/6 W
R36	" -223	"	22 K "
R37	" -103	"	10 K "
R38	" -823	"	82 K "
R39	" -223	"	22 K "
R40	" -223	"	22 K "
R41	" -333	"	33 K "
R42	" -333	"	33 K "
R43	" -223	"	22 K "
R44	" -223	"	22 K "
R45	" -102	"	1 K "
R46	" -102	"	1 K "
R47	" -471	"	470 "
R48	" -471	"	470 "
R49	" -223	"	22 K "
R50	" -223	"	22 K "
R51	" -102	"	1 K "
R52	" -102	"	1 K "
R53	" -473	"	47 K "
R54	" -473	"	47 K "
R55	—	—	
R56	QRD161J-221	CR	220 1/6 W
R57	" -562	"	5.6 K "
R58	" -562	"	5.6 K "
R59	—	—	
R60	QRD161J-562	CR	5.6 K 1/6 W
R61	" -682	"	6.8 K "
R62	" -103	"	10 K "
R63	" -562	"	5.6 K "
R64	" -682	"	6.8 K "
R65	—	—	
R66	QRD163J-0R0	CR	0 1/6 W
R67	QRD161J-0R0	"	0 "
R68	" -472	"	4.7 K "
R69	" -0R0	"	0 "
R70	" -101	"	100 "
R71	—	—	
R72	QRD161J-102	CR	1 K 1/6 W
RA 1	EXB-LD4103G	Resistor Array	
RA 2	RGLD6X472G	"	

Symbol No.	Part No.	Part Name	Description
C 1	QER41HM-225	E Cap	2.2 50 V
C 2	QER40JM-107	"	100 6.3 V
C 3	QCS11HJ-330	C Cap	33 P 50 V
C 4	" -330	"	33 P "
C 5	QER41CM-106	E Cap	10 16 V
C 6	QER40JM-107	"	100 6.3 V
C 7	QCS11HJ-181	C Cap	180 P 50 V
C 8	QER41CM-106	E Cap	10 16 V
C 9	QCF11EZ-472	C Cap	0.0047 25 V
C10	QER41CM-106	E Cap	10 16 V
C11	" -106	"	10 "
C12	—	—	
C13	QER41CM-106	E Cap	10 16 V
C14	—	—	
C15	QER41CM-106	E Cap	10 16 V
C16	QFN41HJ-103	MY Cap	0.01 50 V
C17	" -103	"	0.01 "
C18	" -103	"	0.01 "
C19	" -103	"	0.01 "
C20	—	—	
C21	—	—	
C22	—	—	
C23	QEPA1HM-105	NP Cap	1 50 V
TH 1	PU52108-2R2	Posistor	
S 1	PU53598	Tact Switch	STOP
S 2	"	"	FF
S 3	"	"	REW
S 4	"	"	REV. PB
S 5	"	"	PB
S 6	"	"	STILL/PAUSE
S 7	"	"	A. REC
S 8	"	"	INST.
S 9	"	"	REC
S10	—	—	
S11	PU53598	Tact Switch	EJECT
S12	—	—	
S13	PU53598	Tact Switch	PWR SW
CF 1	PU55812	C. Resonator	4 MHz
CNT 1	S8055VT	Counter	or 8055V1T
	PQ30245-1-1	Counter Holder	
	SPSF2005Z	Tap. Screw	
	SPSF2006Z	Screw	
	PU56577	Flat Wire	
	PQ40937	LED Spacer	
	PU56008	Test Pin	TP1, 2
CN 1	PU56258-12	Cap. Housing	
CN 2	" -12	"	
CN 3	" -12	"	
CN 4	" -12	"	
CN 5	PU54537-4	"	
CN 6	" -2	"	
CN 7	" -3	"	
CN 8	" -3	"	
CN 9	" -2	"	
CN10	" -2	"	
CN11	" -2	"	
CN12	" -2	"	
SUP PWB ASS'Y PU57959A			
Q50	2SC3400	Transistor	Incl. PU57959A
Q51	"	"	"
Q52	"	"	"

6.2.2 Video board ass'y 02 PU11101A

Symbol No.	Part No.	Part Name	Description
[Peripheral section]			
Q301	2SC1545A,B	Transistor	
Q302	"	"	
Q303	2SA881Q,R	"	
Q304	DTC114YS	D. Transistor	
Q305	—	—	
Q306	2SC3400	D. Transistor	
Q307	DTA144F	"	
Q308	DTC144F	"	
D301	1SS133	Diode	
D302	"	"	
D303	"	"	
D304	"	"	
D305	"	"	
D306	"	"	
R301	QRD161J-104	CR	100 K 1/6 W
R302	" -104	"	100 K "
R303	" -104	"	100 K "
R304	" -104	"	100 K "
R305	" -472	"	4.7 K "
R306	" -102	"	1 K "
R307	" -103	"	10 K "
R308	" -153	"	15 K "
R309	" -102	"	1 K "
R310	" -473	"	47 K "
R311	" -473	"	47 K "
R312	" -121	"	120 "
R313	—	—	
R314	QRD161J-103	CR	10 K 1/6 W
R315	" -222	"	2.2 K "
R316	QRD187J-1R0	"	1 1/8 W
C301	QCS11HJ-101	C Cap	100 50 V
C302	" -821	"	820 "
C303	QFN41HJ-562	MY Cap	0.0056 "
C304	—	—	
C305	—	—	
C306	QER41CM-106	E Cap	10 16 V
	PU51212	Fuse Clip	for F 1
RL301	PU56400-2	Relay	
	PU56008	Test Pin	
	PQ40776	Camera Bracket	
	LPSP2606Z	Screw	CA Conn.
	PU56729	Wire Clamp	
	PU56730	Spacer	
	LPSP2608Z	Screw	CA Conn.
	NTS2600Z	Nut	CA Conn.
The following not included in the Board Ass'y			
△ F 1	QMF51E2-2R5	Fuse	T2.5 A 250 V

Symbol No.	Part No.	Part Name	Description
[Luminance section]			
IC 1	T8004	Integrated Circuit	
IC 2	TL8704P	"	
IC 3	—	—	
IC 4	AN6327	Integrated Circuit	
IC 5	5VT09	"	
IC 6	AN6393	"	
IC 7	AN6306	"	
IC 8	AN6392	"	
Q 1	2SC2785HF,FF,EF	Transistor	
Q 2	—	—	
Q 3	2SC2021Q,R,S	D. Transistor	
Q 4	2SA1346	Transistor	
Q 5	2SA1175	"	
Q 6	2SC2785HF,FF,EF	"	
Q 7	2SC2787LF	"	
Q 8	2SB851Q,R	"	
Q 9	2SC3400	D. Transistor	
Q10	2SA1175	Transistor	
Q11	—	—	
Q12	2SC2785HF,FF,EF	Transistor	
Q13	"	"	
Q14	2SA1175	"	
Q15	"	"	
Q16	2SC2785HF,FF,EF	"	
Q17	2SC3400	D. Transistor	
Q18	—	—	
Q19	2SA1175	Transistor	
Q20	2SC2785HF,FF,EF	"	
Q21	"	"	
Q22	2SA1175	"	
Q23	"	"	
Q24	"	"	
Q25	2SC2785HF,FF,EF	"	
Q26	2SC3400	D. Transistor	
Q27	2SC2785HF,FF,EF	Transistor	
Q28	"	"	
Q29	2SC3400	D. Transistor	
Q30	2SB643R,S	Transistor	
Q31	"	"	
Q32	2SC2785HF,FF,EF	"	
Q33	2SB851Q,R	"	
Q34	2SC3400	D. Transistor	
Q35	2SC2785HF,FF,EF	Transistor	
Q36	2SD1055P,Q	"	
Q37	2SC2785HF,FF,EF	"	
Q38	2SC2785FF	"	
Q39	2SA1175FF	"	
D 1	1SS133	Diode	
D 2	OA90	"	
D 3	1SS133	"	
D 4	"	"	
D 5	"	"	
D 6	1SS99	"	
D 7	RD3.3EB	Zener Diode	
D 8	1SS99	Diode	
D 9	"	"	

Symbol No.	Part No.	Part Name	Description
D10	—	—	
D11	RD10EB3	Zener Diode	
D12	1SS133	Diode	
D13	"	"	
D14	"	"	
D15	"	"	
D16	"	"	
D17	"	"	
D18	"	"	
R 1	—	—	
R 2	QRD161J-182	CR	1.8 K 1/6 W
R 3	" -392	"	3.9 K "
R 4	" -821	"	820 "
R 5	" -272	"	2.7 K "
R 6	" -684	"	680 K "
R 7	" -0R0	"	0 "
R 8	" -182	"	1.8 K "
R 9	" -102	"	1 K "
R10	" -331	"	330 "
R11	" -393	"	39 K "
R12	" -223	"	22 K "
R13	" -103	"	10 K "
R14	QVZ3531-222	VR	2.2 K "
R15	QRD161J-222	CR	2.2 K "
R16	" -473	"	47 K "
R17	" -183	"	18 K "
R18	QVZ3531-102	VR	1 K "
R19	QRD161J-102	CR	1 K 1/6 W
R20	" -331	"	330 "
R21	" -181	"	180 "
R22	" -561	"	560 "
R23	" -822	"	8.2 K "
R24	" -333	"	33 K "
R25	" -182	"	1.8 K "
R26	—	—	
R27	QRD161J-682	CR	6.8 K 1/6 W
R28	" -223	"	22 K "
R29	" -103	"	10 K "
R30	—	—	
R31	QRD161J-822	CR	8.2 K 1/6 W
R32	" -473	"	47 K "
R33	" -222	"	2.2 K "
R34	" -331	"	330 "
R35	" -564	"	560 K "
R36	" -122	"	1.2 K "
R37	" -102	"	1 K "
R38	" -684	"	680 K "
R39	" -154	"	150 K "
R40	" -100	"	10 "
R41	" -222	"	2.2 K "
R42	" -681	"	680 "
R43	" -821	"	820 "
R44	" -392	"	3.9 K "
R45	" -103	"	10 K "
R46	" -122	"	1.2 K "
R47	—	—	
R48	QRD161J-0R0	CR	0 1/6 W
R49	—	—	
R50	QRD161J-102	CR	1 K 1/6 W
R51	QVZ3531-222	VR	2.2 K "
R52	QRD161J-102	CR	1 K 1/6 W
R53	" -222	"	2.2 K "
R54	" -102	"	1 K "
R55	" -152	"	1.5 K "

Symbol No.	Part No.	Part Name	Description
R56	QRD161J-181	CR	180 1/6 W
R57	" -102	"	1 K "
R58	" -223	"	22 K "
R59	" -102	"	1 K "
R60	" -102	"	1 K "
R61	" -750	"	75 "
R62	" -330	"	33 "
R63	" -222	"	2.2 K "
R64	" -103	"	10 K "
R65	" -222	"	2.2 K "
R66	" -750	"	75 "
R67	" -681	"	680 "
R68	" -681	"	680 "
R69	" -103	"	10 K "
R70	" -103	"	10 K "
R71	" -221	"	220 "
R72	" -122	"	1.2 K "
R73	" -332	"	3.3 K "
R74	" -102	"	1 K "
R75	" -102	"	1 K "
R76	" -183	"	18 K "
R77	" -393	"	39 K "
R78	" -332	"	3.3 K "
R79	" -224	"	220 K "
R80	QVZ3531-103	VR	10 K
R81	—	—	
R82	QRD161J-563	CR	56 K 1/6 W
R83	" -682	"	6.8 K "
R84	QVZ3531-103	VR	10 K
R85	—	—	
R86	QRD161J-0R0	CR	0 1/6 W
R87	QVZ3531-222	VR	2.2 K
R88	QRD161J-103	CR	10 K 1/6 W
R89	" -223	"	22 K "
R90	" -331	"	330 "
R91	" -681	"	680 "
R92	" -181	"	180 "
R93	" -103	"	10 K "
R94	" -102	"	1 K "
R95	—	—	
R96	QRD161J-332	CR	3.3 K 1/6 W
R97	" -152	"	1.5 K "
R98	" -221	"	220 "
R99	" -562	"	5.6 K "
R100	" -152	"	1.5 K "
R101	" -272	"	2.7 K "
R102	" -181	"	180 "
R103	" -222	"	2.2 K "
R104	" -222	"	2.2 K "
R105	" -222	"	2.2 K "
R106	" -222	"	2.2 K "
R107	" -332	"	3.3 K "
R108	" -682	"	6.8 K "
R109	" -272	"	2.7 K "
R110	QVZ3531-682	VR	6.8 K
R111	" -103	"	10 K
R112	—	—	
R113	QVZ3531-103	VR	10 K
R114	QRD161J-103	CR	10 K 1/6 W
R115	" -822	"	8.2 K "
R116	" -470	"	47 "
R117	" -393	"	39 K "
R118	" -563	"	56 K "
R119	" -563	"	56 K "
R120	" -223	"	22 K "

Symbol No.	Part No.	Part Name	Description
R121	QRD161J-223	CR	22 K 1/6 W
R122	" -222	"	2.2 K "
R123	" -102	"	1 K "
R124	" -392	"	3.9 K "
R125	" -121	"	120 "
R126	" -152	"	1.5 K "
R127	" -820	"	82 "
R128	" -393	"	39 K "
R129	" -331	"	330 "
R130	" -223	"	22 K "
R131	" -103	"	10 K "
R132	" -222	"	2.2 K "
R133	" -103	"	10 K "
R134	" -222	"	2.2 K "
R135	" -104	"	100 K "
R136	" -473	"	47 K "
R137	" -822	"	8.2 K "
R138	" -102	"	1 K "
R139	" -430	"	43 "
R140	" -122	"	1.2 K "
R141	" -182	"	1.8 K "
R142	" -102	"	1 K "
R143	" -223	"	22 K "
R144	" -102	"	1 K "
R145	" -103	"	10 K "
R146	—	—	
R147	—	—	
R148	QRD161J-222	CR	2.2 K 1/6 W
R149	—	—	
R150	QRD161J-4R7	CR	4.7 1/6 W
R151	" -4R7	"	4.7 "
R152	" -103	"	10 K "
R153	" -222	"	2.2 K "
R154	" -152	"	1.5 K "
R155	" -824	"	820 K "
R156	" -152	"	1.5 K "
R157	" -821	"	820 "
B 1	—	—	
B 2	QRD187J-0R0	CR	0
B 3	QRD161J-0R0	"	0
B 4	" -0R0	"	0
B 5	" -0R0	"	0
B 6	QRD187J-0R0	"	0
B 7	—	—	
B 8	—	—	
B 9	QRD167J-0R0	CR	0

Symbol No.	Part No.	Part Name	Description
C 1	—	—	
C 2	—	—	
C 3	PU51163-271	C Cap	270 50 V
C 4	QCS11HJ-220	"	22 P "
C 5	QCS51HJ-680	"	68 P "
C 6	QCY71HK-181	"	180 "
C 7	" -181	"	180 "
C 8	—	—	
C 9	—	—	
C10	QCS51HJ-390	C Cap	39 P 50 V
C11	" -560	"	56 P "
C12	QCS11HJ-8R0	"	8 P "
C13	QCX31EM-103	"	0.01 25 V
C14	QER40JM-476	E Cap	47 6.3 V
C15	QCF11HP-103	C Cap	0.01 50 V
C16	QEPA1HM-474	E Cap	0.47 "
C17	QER41HM-104	"	0.1 "
C18	" -105	"	1 "
C19	QER41CM-106	"	10 16 V
C20	" -106	"	10 "
C21	QCS11HJ-270	C Cap	27 P 50 V
C22	" -820	"	82 P "
C23	" -270	"	27 P "
C24	" -560	"	56 P "
C25	" -560	"	56 P "
C26	QCS51HJ-101	"	100 P "
C27	QCX31EM-153	"	0.015 25 V
C28	QER41CM-106	E Cap	10 16 V
C29	QCX31EM-153	C Cap	0.015 25 V
C30	QER41HM-105	E Cap	1 50 V
C31	" -105	"	1 "
C32	QCX31EM-153	C Cap	0.015 25 V
C33	QCF11HP-103	"	0.01 50 V
C34	QCX31EM-153	"	0.015 25 V
C35	QER41HM-104	E Cap	0.1 50 V
C36	QCX31EM-153	C Cap	0.015 25 V
C37	QER41CM-476	E Cap	47 16 V
C38	QFN41HJ-222	MY Cap	0.0022 50 V
C39	QCV31HK-222	C Cap	0.0022 "
C40	QCY71HK-102	"	0.001 "
C41	QCX31EM-103	"	0.01 25 V
C42	" -103	"	0.01 "
C43	QCT05CH-390	"	39 P
C44	QCS11HJ-221	"	220 P 50 V
C45	QER41EM-475	E Cap	4.7 25 V
C46	QER41CM-106	"	10 16 V
C47	" -106	"	10 "
C48	QCS11HJ-101	C Cap	100 P 50 V
C49	QER41HM-105	E Cap	1 "
C50	QEPA1HM-105	"	1 "
C51	QCS11HJ-221	C Cap	220 P "
C52	QER41HM-105	E Cap	1 "
C53	QER40JM-107	"	100 6.3 V
C54	QCF11HP-103	C Cap	0.01 50 V
C55	QCS11HJ-220	"	22 P "
C56	QCF11HP-103	"	0.01 "
C57	" -103	"	0.01 "
C58	QCX31EM-103	"	0.01 25 V
C59	" -103	"	0.01 "
C60	" -103	"	0.01 "
C61	QCT05CH-330	"	33
C62	QCX31EM-153	"	0.015 25 V
C63	QCS51HJ-470	"	47 P 50 V
C64	QCX31EM-153	"	0.015 25 V
C65	" -103	"	0.01 "

Symbol No.	Part No.	Part Name	Description
C66	QFN41HJ-223	MY Cap	0.022 50 V
C67	QCS51HJ-560	C Cap	56 P "
C68	QCF11HP-103	"	0.01 "
C69	QER40JM-476	E Cap	47 6.3 V
C70	QCX31EM-103	C Cap	0.01 25 V
C71	QCS41HJ-470	"	47 P 50 V
C72	QCS11HJ-270	"	27 P "
C73	" -680	"	68 P "
C74	QCF11HP-103	"	0.01 "
C75	QCS11HJ-101	"	100 P "
C76	—	—	
C77	QCS11HJ-471	C Cap	470 P 50 V
C78	—	—	
C79	PU54990-3	E Cap	
C80	QER41CM-476	"	47 16 V
C81	QCF11HP-103	C Cap	0.01 50 V
C82	" -103	"	0.01 "
C83	QER41CM-476	E Cap	47 16 V
C84	QER41AM-226	"	22 10 V
C85	QCX31EM-153	C Cap	0.015 25 V
C86	QER40JM-476	E Cap	47 6.3 V
C87	QER41CM-106	"	10 16 V
C88	QER41EM-475	"	4.7 25 V
C89	QER40GM-227	"	220 4 V
C90	QER41EM-335	"	3.3 25 V
C91	QCF11HP-103	C Cap	0.01 50 V
C92	QCS11HJ-121	"	120 P "
C93	QER40JM-107	E Cap	100 6.3 V
C94	QCF11HP-103	C Cap	0.01 50 V
C95	" -103	"	0.01 "
C96	" -103	"	0.01 "
C97	" -103	"	0.01 "
C98	QCS51HJ-121	"	120 P "
C99	" -121	"	120 P "
C100	—	—	
C101	QER40JM-476	E Cap	47 6.3 V
C102	QER41HM-105	"	1 50 V
C103	QER41CM-106	"	10 16 V
C104	QCY71HK-331	C Cap	330 P 50 V
C105	" -391	"	390 P "
C106	QER41EM-475	E Cap	4.7 25 V
C107	PU51163-181	C Cap	180 P
C108	—	—	
C109	QCF11HP-103	C Cap	0.01 50 V
C110	QCX31EM-153	"	0.015 25 V
C111	" -153	"	0.015 "
C112	QCS11HJ-470	"	47 P 50 V
C113	QCF11HP-223	"	0.022 "
C114	QER41HM-105	E Cap	1 "
C115	QCF11HP-103	C Cap	0.01 "
C116	QER41CM-106	E Cap	10 16 V
C117	" -476	"	47 "
C118	QCF11HP-103	C Cap	0.01 50 V
C119	QER41CM-106	E Cap	10 16 V
C120	QCX31EM-153	C Cap	0.015 25 V
C121	QCS11HJ-121	"	120 P 50 V
C122	QCY71HJ-151	"	150 P "
C123	QCS11HJ-270	"	27 P "
C124	—	—	
C125	QEPA0JM-476	NP Cap	47 6.3 V
C126	QCT05CH-390	C Cap	39 P
C127	QER41HM-224	E Cap	0.22 50 V
C128	QCS11HJ-470	C Cap	47 P "
C129	QCX31EM-153	"	0.015 25 V
C130	QCS11HJ-7R0	"	7 P 50 V

Symbol No.	Part No.	Part Name	Description
C131	QCS11HJ-100	C Cap	10 P 50 V
C132	—	—	
C133	QCS11HJ-680	C Cap	68 P 50 V
C134	QFN41HJ-563	MY Cap	0.056 "
C135	QER40JM-476	E Cap	47 6.3 V
C136	QCF11HP-223	C Cap	0.022 50 V
C137	" -103	"	0.01 "
C138	QCS11HJ-150	"	15 P "
L 1	—	—	
L 2	PU53618-391JF	Peaking Coil	390
L 3	PU53223-470JG	"	47 μ H
L 4	—	—	
L 5	PU53223-270JG	Peaking Coil	27 μ H
L 6	" -470JG	"	47 μ H
L 7	" -101G	"	100 μ H
L 8	" -2R7KG	"	2.7 μ H
L 9	" -8R2JG	"	8.2 μ H
L10	" -680JG	"	68 μ H
L11	" -680JG	"	68 μ H
L12	" -101G	"	100 μ H
L13	" -101G	"	100 μ H
L14	" -180JG	"	18 μ H
L15	" -180JG	"	18 μ H
L16	" -101JG	"	100 μ H
L17	" -120JG	"	12 μ H
L18	" -180JG	"	18 μ H
L19	" -101G	"	100 μ H
L20	" -470JG	"	47 μ H
L21	" -151JG	"	150 μ H
L22	" -101G	"	100 μ H
L23	" -101G	"	100 μ H
L24	" -101G	"	100 μ H
L25	" -680JG	"	68 μ H
L26	" -271JG	"	270 μ H
L27	" -181JG	"	180 μ H
L28	" -100JG	"	10 μ H
L29	" -101G	"	100 μ H
L30	" -101JG	"	100 μ H
LPF 1	PU57122	Low Pass Filter	
CF 1	PU57073	Ceramic Filter	13.29 MHz
IB 1	PU35238-001	Inline Block	
EQ 1	PU57219	Equalizer	
EQ 2	PU54838	"	

Symbol No.	Part No.	Part Name	Description
[Color section]			
IC201	HA11756	Integrated Circuit	
IC202	BA7007	"	
Q201	2SC2785HF,FF,EF	Transistor	
Q202	"	"	
Q203	"	"	
Q204	"	"	
Q205	2SC3400	D. Transistor	
Q206	—	—	
Q207	2SC2785HF,FF,EF	Transistor	
Q208	2SB643R,S	"	
Q209	2SC2785HF,FF,EF	"	
Q210	"	"	
Q211	"	"	
Q212	"	"	
Q213	"	"	
Q214	2SA1346	D. Transistor	
Q215	2SC3400	"	
Q216	2SC2787LF	Transistor	
Q217	2SC2785HF,FF,EF	"	
Q218	2SC3400	D. Transistor	
Q219	"	"	
Q220	2SC2785HF,FF,EF	Transistor	
Q221	"	"	
Q222	"	"	
Q223	2SC3400	D. Transistor	
Q224	"	"	
Q225	2SB643R,S	Transistor	
Q226	2SA1346	D. Transistor	
Q227	2SC3400	"	
D201	1SS133	Diode	
D202	"	"	
D203	"	"	
D204	"	"	
D205	"	"	
R201	QVZ3531-331	VR	330
R202	QRD161J-681	CR	680 1/6 W
R203	" -102	"	1 K "
R204	" -103	"	10 K "
R205	" -121	"	120 "
R206	" -102	"	1 K "
R207	" -122	"	1.2 K "
R208	" -102	"	1 K "
R209	" -102	"	1 K "
R210	" -183	"	18 K "
R211	" -562	"	5.6 K "
R212	" -682	"	6.8 K "
R213	" -152	"	1.5 K "
R214	" -222	"	2.2 K "
R215	" -222	"	2.2 K "
R216	" -122	"	1.2 K "
R217	—	—	
R218	QRD161J-152	CR	1.5 K 1/6 W
R219	" -472	"	4.7 K "
R220	QVZ3531-223	VR	22 K

Symbol No.	Part No.	Part Name	Description
R221	QRD161J-472	CR	4.7 K 1/6 W
R222	QVZ3531-103	VR	10 K
R223	QRD161J-332	CR	3.3 K 1/6 W
R224	" -561	"	560 "
R225	" -102	"	1 K "
R226	" -102	"	1 K "
R227	" -222	"	2.2 K "
R228	" -103	"	10 K "
R229	" -222	"	2.2 K "
R230	" -102	"	1 K "
R231	" -272	"	2.7 K "
R232	" -391	"	390 "
R233	" -223	"	22 K "
R234	" -102	"	1 K "
R235	" -102	"	1 K "
R236	" -473	"	47 K "
R237	" -274	"	270 K "
R238	" -472	"	4.7 K "
R239	QVZ3531-103	VR	10 K
R240	QRD161J-103	CR	10 K 1/6 W
R241	" -103	"	10 K "
R242	" -681	"	680 "
R243	QVZ3531-102	VR	1 K
R244	QRD161J-391	CR	390 1/6 W
R245	" -471	"	470 "
R246	" -122	"	1.2 K "
R247	" -821	"	820 "
R248	" -331	"	330 "
R249	" -102	"	1 K "
R250	" -222	"	2.2 K "
R251	" -103	"	10 K "
R252	—	—	
R253	QRD161J-102	CR	1 K 1/6 W
R254	" -154	"	150 K "
R255	" -683	"	68 K "
R256	" -182	"	1.8 K "
R257	QVZ3531-102	VR	1 K
R258	—	—	
R259	QRD161J-103	CR	10 K 1/6 W
R260	" -333	"	33 K "
R261	" -562	"	5.6 K "
R262	" -103	"	10 K "
R263	—	—	
R264	QRD161J-223	CR	22 K 1/6 W
R265	" -102	"	1 K "
R266	" -103	"	10 K "
R267	" -104	"	100 K "
R268	" -331	"	330 "
R269	" -153	"	15 K "
R270	" -183	"	18 K "
R271	" -183	"	18 K "
R272	" -183	"	18 K "
R273	" -103	"	10 K "
R274	" -273	"	27 K "
R275	" -221	"	220 "
R276	" -222	"	2.2 K "
R277	" -103	"	10 K "
R278	" -472	"	4.7 K "
R279	" -820	"	82 "

Symbol No.	Part No.	Part Name	Description
C201	QCF11HP-103	C Cap	0.01 50 V
C202	QFN41HJ-333	MY Cap	0.033 "
C203	QCF11HP-103	C Cap	0.01 "
C204	—	—	
C205	—	—	
C206	QCF11HP-103	C Cap	0.01 50 V
C207	QEE41VM-684	TAN Cap	0.68 35 V
C208	QCF11HP-103	C Cap	0.01 50 V
C209	QFN41HJ-102	MY Cap	0.001 "
C210	QCS11HJ-101	C Cap	100 P "
C211	QFN41HJ-473	MY Cap	0.047 "
C212	QER41EM-475	E Cap	4.7 25 V
C213	" -475	"	4.7 "
C214	QCF11HP-103	C Cap	0.01 50 V
C215	" -103	"	0.01 "
C216	" -103	"	0.01 "
C217	" -103	"	0.01 "
C218	" -103	"	0.01 "
C219	" -223	"	0.022 "
C220	QER41HM-225	E Cap	2.2 "
C221	QCF11HP-103	C Cap	0.01 "
C222	QER40JM-476	E Cap	47 6.3 V
C223	QCF11HP-103	C Cap	0.01 50 V
C224	QFN41HJ-472	MY Cap	0.0047 "
C225	QER40JM-107	E Cap	100 6.3 V
C226	QCF11HP-103	C Cap	0.01 50 V
C227	QFN41HJ-223	MY Cap	0.022 "
C228	QER41HM-105	E Cap	1 "
C229	—	—	
C230	QFN41HJ-563	MY Cap	0.056 50 V
C231	QEE41VK-224	TAN Cap	0.22 35 V
C232	QEE41AM-685	"	6.8 10 V
C233	QCT05CH-180	C Cap	18 P
C234	" -180	"	18 P
C235	" -470	"	47 P
C236	QFN41HJ-682	MY Cap	0.0068 50 V
C237	QCF11HP-103	C Cap	0.01 "
C238	QFN41HJ-473	MY Cap	0.047 "
C239	QCF11HP-103	C Cap	0.01 "
C240	QCS11HJ-470	"	47 P "
C241	QCF11HP-103	"	0.01 "
C242	QCS11HJ-101	"	100 P "
C243	QCF11HP-103	"	0.01 "
C244	QCS11HJ-101	"	100 P "
C245	QCF11HP-103	"	0.01 "
C246	QCX31EM-103	"	0.01 25 V
C247	QCF11HP-103	"	0.01 50 V
C248	QCX31EM-103	"	0.01 25 V
C249	QER40JM-476	E Cap	47 6.3 V
C250	QCX31EM-103	C Cap	0.01 25 V
C251	QER41AM-336	E Cap	33 10 V
C252	QER40JM-476	"	47 6.3 V
C253	QCF11HP-103	C Cap	0.01 50 V
C254	QER41CM-106	E Cap	10 16 V
C255	QFN41HJ-182	MY Cap	0.0018 50 V
C256	" -272	"	0.0027 "
C257	QCF11HP-103	C Cap	0.01 "
C258	—	—	
C259	QCS11HJ-101	C Cap	100 P 50 V
C260	QCF11HP-103	"	0.01 "
C261	" -103	"	0.01 "
C262	QFN41HJ-473	MY Cap	0.047 "
C263	QCS11HJ-680	C Cap	68 P "
C264	QFN41HJ-104	MY Cap	0.1 "
C265	" -272	"	0.0027 "

Symbol No.	Part No.	Part Name	Description
C266	QFN41HJ-223	MY Cap	0.022 50 V
C267	" -473	"	0.047 "
L201	—	—	
L202	PU53223-101G	Peaking Coil	100 μ H
L203	" -101G	"	100 μ H
L204	PU53607-822	"	8.2 mH
L205	PU53618-101F	"	100 μ H
L206	" -821JF	"	820 μ H
L207	PU54710-222	Coil	2.2 mH
L208	PU53223-271JG	Peaking Coil	270 μ H
L209	" -150JG	"	15 μ H
L210	" -101G	"	100 μ H
L211	" -101G	"	100 μ H
L212	PU53607-562	"	5.6 mH
L213	PU49057	LC Block	
LPF201	PU54988	Low Pass Filter	
LPF202	PU54408-2	"	
BPF201	PU54410-2	Band Pass Filter	
BPF202	PU54409-2	"	
EQ201	PU54404	Equalizer	
CF201	PU56983	Ceramic Filter	
DL201	PU57015	2H Comb Filter	
IB201	PU35238-002	Inline Block	
IB202	" -003	"	
IB203	" -009	"	
IB204	" -005	"	
X201	PU31449-2	Crystal	
X202	PU57254	Crystal Osc.	

Symbol No.	Part No.	Part Name	Description
[Switching regulator section]			
IC401	AN6913	Integrated Circuit	or TA75393S
IC402	M5236L	"	
Q401	2SA1282AF	Transistor	
Q402	"	"	
Q403	"	"	
D401	11DQ04	Diode	
D402	"	"	
D403	LTZ-R15	"	
D404	1SS133	"	
D405	RD8.2EB2	Zener Diode	
R401	QRD161J-331	CR	330 1/6 W
R402	" -122	"	1.2 K "
R403	" -472	"	4.7 K "
R404	" -123	"	12 K "
R405	QVZ3531-103	VR	10 K
R406	QRD161J-822	CR	8.2 K 1/6 W
R407	" -332	"	3.3 K "
R408	QVZ3531-102	VR	1 K
R409	QRD161J-122	CR	1.2 K 1/6 W
R410	" -331	"	330 "
R411	" -122	"	1.2 K "
R412	" -273	"	27 K "
R413	" -472	"	4.7 K "
R414	" -104	"	100 K "
R415	" -104	"	100 K "
R416	" -0R0	"	0 "
R417	" -221	"	220 "
C401	QET41CM-476	E Cap	47 16 V
C402	QEC81CM-476	"	47 "
C403	QEM41AK-107	"	100 10 V
C404	QET41AM-476	"	47 "
C405	QCS31HJ-560	C Cap	56 P 50 V
C406	QEK51CM-106	E Cap	10 16 V
C407	QCS31HJ-560	C Cap	56 P 50 V
C408	QET41CM-476	E Cap	47 16 V
L401	PU56181-470	Choke Coil	47 μ H
L402	PU55811-221	"	220 μ H
L403	" -391	"	390 μ H
CP401	ICP-F20	IC Protector	

Symbol No.	Part No.	Part Name	Description
CN 1	PU56259-12	Cap. Housing	
CN 2	" -12	"	
CN 3	" -12	"	
CN 4	PU54537-6	"	
CN 5	" -6	"	
CN 6	PU56259-8	"	
CN 7	PU56543-7	Board HSG Ass'y	
CN 8	PU56259-20	Cap. Housing	
CN 9	" -12	"	
CN10	PU56554	Camera Connector	
CN11	PU54537-10	Cap. Housing	
CN12	" -7	"	
CN13	" -2	"	
CN14	PU56259-12	"	

6.2.3 Servo board ass'y 03 PU21817B

Symbol No.	Part No.	Part Name	Description
IC 1	BAF6305-T1	Flat IC	
IC 2	UPD4030BG-T2	Integrated Circuit	
IC 3	M50767-604P	"	
IC 4	HA11780MP	"	
IC 5	BA6302AF-T1	"	
IC 6	UPD4066BG-T2	"	
IC 7	BA833F	"	
IC 8	BA6328F-T1	"	
IC 9	UPC277G-T2	Flat IC	or UPC277G2-T2
IC10	BA6302AF-T1	Integrated Circuit	
IC11	UPC451G-T1	Flat IC	or UPC451G2-T1
Q 1	DTC124KT-96	Chip Transistor	or UN2212-TX
Q 2	—	—	
Q 3	—	—	
Q 4	DTA124KT-97	Chip Transistor	or UN2112-TW
Q 5	2SA1037KT-96R,S	"	or 2SB709-TX
Q 6	2SC2412KT-96R,S	"	or 2SD601-TX
Q 7	" -96R,S	"	or "
Q 8	DTA124KT-97	"	or UN2112-TW
Q 9	2SA1037KT-96R,S	"	or 2SB709-TX
Q10	2SC2412KT-97R,S	"	or 2SD601-TW
Q11	2SA1037KT-97R,S	"	or 2SB709-TW
D 1	—	—	
D 2	DA204KT-96	Chip Diode	
D 3	" -97	"	
D 4	" -96	"	
D 5	DAN202KT-96	"	or MA151WK-TX
D 6	DA204KT-97	"	
D 7	DAP202KT-96	"	or MA151WA-TX
D 8	DA204KT-97	"	
D 9	" -97	"	
D10	—	—	
D11	—	—	
D12	1SS133	Diode	
R 1	QRS188J-103YN	Chip R	10 K 1/8 W
R 2	" -105YN	"	1 M "
R 3	" -223YN	"	22 K "
R 4	" -102YN	"	1 K "
R 5	" -102YN	"	1 K "
R 6	" -684YN	"	680 K "
R 7	" -683YN	"	68 K "
R 8	" -103YN	"	10 K "
R 9	" -103YN	"	10 K "
R10	" -103YN	"	10 K "
R11	" -103YN	"	10 K "
R12	" -103YN	"	10 K "
R13	—	—	
R14	—	—	
R15	QVZ3531-473	VR	47 K

Symbol No.	Part No.	Part Name	Description
R16	QRS188 J-823YN	Chip R	82 K 1/8 W
R17	" -823YN	"	82 K "
R18	" -272YN	"	2.7 K "
R19	" -334YN	"	330 K "
R20	" -333YN	"	33 K "
R21	" -472YN	"	4.7 K "
R22	—	—	
R23	QRS188 J-103YN	Chip R	10 K 1/8 W
R24	" -103YN	"	10 K "
R25	—	—	
R26	—	—	
R27	—	—	
R28	QVZ3531-474	VR	470 K
R29	QRS188 J-394YN	Chip R	390 K 1/8 W
R30	" -103YN	"	10 K "
R31	" -334YN	"	330 K "
R32	" -104YN	"	100 K "
R33	" -224YN	"	220 K "
R34	" -473YN	"	47 K "
R35	" -102YN	"	1 K "
R36	PU56289-504	VR	500 K
R37	QRS188 J-153YN	Chip R	15 K 1/8 W
R38	QVZ3531-103	VR	10 K
R39	QRS188 J-103YN	Chip R	10 K 1/8 W
R40	" -824YN	"	820 K "
R41	" -105YN	"	1 M "
R42	" -221YN	"	220 "
R43	" -394YN	"	390 K "
R44	" -104YN	"	100 K "
R45	" -105YN	"	1 M "
R46	" -473YN	"	47 K "
R47	QVZ3531-104	VR	100 K
R48	QRS188 J-824YN	Chip R	820 K 1/8 W
R49	" -104YN	"	100 K "
R50	" -333YN	"	33 K "
R51	" -333YN	"	33 K "
R52	" -103YN	"	10 K "
R53	" -103YN	"	10 K "
R54	" -333YN	"	33 K "
R55	" -222YN	"	2.2 K "
R56	" -222YN	"	2.2 K "
R57	" -222YN	"	2.2 K "
R58	" -473YN	"	47 K "
R59	QVZ3531-333	VR	33 K
R60	QRS188 J-184YN	Chip R	180 K 1/8 W
R61	" -334YN	"	330 K "
R62	" -333YN	"	33 K "
R63	" -103YN	"	10 K "
R64	" -103YN	"	10 K "
R65	" -104YN	"	100 K "
R66	" -105YN	"	1 M "
R67	" -103YN	"	10 K "
R68	" -224YN	"	220 K "
R69	QVZ3531-104	VR	100 K
R70	QRS188 J-104YN	Chip R	100 K 1/8 W
R71	" -103YN	"	10 K "
R72	" -682YN	"	6.8 K "
R73	" -564YN	"	560 K "
R74	" -472YN	"	4.7 K "
R75	" -563YN	"	56 K "
R76	" -103YN	"	10 K "
R77	" -684YN	"	680 K "
R78	" -683YN	"	68 K "
R79	" -103YN	"	10 K "
R80	" -105YN	"	1 M "

Symbol No.	Part No.	Part Name	Description
R81	QRS188 J-104YN	Chip R	100 K 1/8 W
R82	" -103YN	"	10 K "
R83	" -103YN	"	10 K "
R84	" -103YN	"	10 K "
R85	" -474YN	"	470 K "
R86	—	—	
R87	—	—	
R88	QRS188 J-103YN	Chip R	10 K 1/8 W
R89	" -103YN	"	10 K "
R90	" -104YN	"	100 K "
R91	—	—	
R92	—	—	
R93	QVZ3531-474	VR	470 K
R94	QRS188 J-104YN	Chip R	100 K 1/8 W
R95	QVZ3531-474	VR	470 K
R96	QRS188 J-104YN	Chip R	100 K 1/8 W
R97	QVZ3531-473	VR	47 K
R98	QRS188 J-224YN	Chip R	220 K 1/8 W
R99	" -224YN	"	220 K "
R100	" -103YN	"	10 K "
R101	QVZ3531-224	VR	220 K
R102	QRS188 J-473YN	Chip R	47 K 1/8 W
R103	QVZ3531-224	VR	220 K
R104	QRS188 J-103YN	Chip R	10 K 1/8 W
R105	" -105YN	"	1 M "
R106	" -103YN	"	10 K "
R107	" -564YN	"	560 K "
R108	" -392YN	"	3.9 K "
R109	—	—	
R110	QRS188 J-223YN	Chip R	22 K 1/8 W
R111	" -223YN	"	22 K "
R112	" -223YN	"	22 K "
R113	" -223YN	"	22 K "
R114	" -223YN	"	22 K "
R115	—	—	
R116	QRS188 J-223YN	Chip R	22 K 1/8 W
R117	" -223YN	"	22 K "
R118	" -223YN	"	22 K "
R119	" -223YN	"	22 K "
R120	" -562YN	"	5.6 K "
R121	ERT-D2FHL103S	Thermistor	
R122	QRS188 J-334YN	Chip R	330 K 1/8 W
R123	QRD161J-472	CR	4.7 K 1/6 W
R124	" -103	"	10 K "
R125	" -223	"	22 K "
C 1	QEK41HM-105	E Cap	1 50 V
C 2	QCY81HK-103ZL	Chip Cap	0.01 "
C 3	QCS81HJ-221ZL	"	220 P "
C 4	QEK41AM-476	E Cap	47 10 V
C 5	" -226	"	22 "
C 6	QCY81HK-102ZL	Chip Cap	0.001 50 V
C 7	QER41AM-476	E Cap	47 10 V
C 8	QCS81HJ-101ZL	Chip Cap	100 P 50 V
C 9	QER41AM-476	E Cap	47 10 V
C10	QCY81HK-103ZL	Chip Cap	0.01 50 V

Symbol No.	Part No.	Part Name	Description
C11	QFN41HJ-223	MY Cap	0.022 50 V
C12	QCY81HK-103ZL	Chip Cap	0.01 "
C13	" -472ZL	"	0.0047 "
C14	QER41AM-226	E Cap	22 10 V
C15	QER41HM-105	"	1 50 V
C16	QER41AM-226	"	22 10 V
C17	QFZ9011-124	MY Cap	0.12 63 V
C18	" -104	"	0.1 "
C19	QEP41HM-105	NP Cap	1 50 V
C20	QCY81HK-102ZL	Chip Cap	0.001 "
C21	QCS81HJ-331ZL	"	330 P "
C22	QCY81EK-333ZL	"	0.033 25 V
C23	QFN41HJ-273	MY Cap	0.027 50 V
C24	QFZ9011-104	"	0.1 63 V
C25	" -124	"	0.12 "
C26	QEK41AM-226	E Cap	22 10 V
C27	QFZ9011-104	MY Cap	0.1 63 V
C28	QCY81HK-102ZL	Chip Cap	0.001 50 V
C29	" -102ZL	"	0.001 "
C30	QFN41HJ-123	MY Cap	0.012 "
C31	QCS81HJ-331ZL	Chip Cap	330 P "
C32	QCY81EK-333ZL	"	0.033 25 V
C33	QFN41HJ-273	MY Cap	0.027 50 V
C34	QEL60JM-226G	E Cap	22 6.3 V
C35	" -226G	"	22 "
C36	QCY81EK-563ZL	Chip Cap	0.056 25 V
C37	" -563ZL	"	0.056 "
C38	QFP42AJ-102	PP Cap	0.001 100 V
C39	—	—	
C40	QCY81HK-102ZL	Chip Cap	0.001 50 V
C41	QCS81HJ-820ZL	"	82 P "
C42	QER41AM-226	E Cap	22 10 V
C43	QER41HM-474	"	0.47 50 V
C44	—	—	
C45	QEF81CM-105W	Chip T Cap	1 16 V
C46	—	—	
C47	QFP42AJ-272	PP Cap	0.0027 100 V
C48	QCY81HK-103ZL	Chip Cap	0.01 50 V
C49	" -103ZL	"	0.01 "
C50	QCS81HJ-101ZL	"	100 P "
C51	QER41AM-226	E Cap	22 10 V
C52	QCY81EK-223ZL	Chip Cap	0.022 25 V
C53	QER41AM-226	E Cap	22 10 V
C54	QEP41AM-106	NP Cap	10 "
C55	QFN41HJ-823	MY Cap	0.082 50 V
C56	QEP41HM-474	NP Cap	0.47 "
C57	" -105	"	1 "
C58	QEK41AM-226	E Cap	22 10 V
C59	—	—	
C60	QFN41HK-682	MY Cap	0.0068 50 V
C61	" -682	"	0.0068 "
C62	QCY81HK-103ZL	Chip Cap	0.01 "
C63	QEK41CM-106	E Cap	10 16 V
C64	QCY81HK-102ZL	Chip Cap	0.001 50 V
C65	" -102ZL	"	0.001 "
C66	" -122ZL	"	0.0012 "
C67	" -682ZL	"	0.0068 "
C68	QEK40JM-107	E Cap	100 6.3 V
C69	QFN41HK-222	MY Cap	0.0022 50 V
C70	QCY81HK-102ZL	Chip Cap	0.001 "
C71	" -102ZL	"	0.001 "
C72	QER41CM-106	E Cap	10 16 V
C73	QCS11HK-471	C Cap	470 P 50 V

6.2.4 MDA board ass'y 04 PU57256B

Symbol No.	Part No.	Part Name	Description
L 1	PU53223-101JG	Peaking Coil	100 μ H
L 2	PU56181-330	Choke Coil	33 μ H
X 1	PU47701	Crystal	32.768 kHz
CN 1	PU56258-20	Cap. Housing	
CN 2	" -12	"	
CN 3	PU53587-2	"	
CN 4	PU54537-6	"	
CN 5	" -2	"	
CN 6	PU56259-8	"	
CN 7	PU54537-2	"	
	PU56008	Test Pin	TP1, 3, 6, 7, 11, 21, 22, GND, FM
	PQ30241	Terminal Holder	
	PQ40759-1-2	Battery Terminal	

Symbol No.	Part No.	Part Name	Description
IC 1	AN6671	Integrated Circuit	or AN6671K
Q 1	2SA10200,Y	Transistor	
D 1	11DQ04	Diode	
R 1	QRD161J-332	CR	3.3 K 1/6 W
R 2	" -102	"	1 K "
R 3	" -102	"	1 K "
R 4	" -102	"	1 K "
R 5	" -223	"	22 K "
R 6	" -561	"	560 "
R 7	" -473	"	47 K "
R 8	" -333	"	33 K "
R 9	" -472	"	4.7 K "
R10	" -223	"	22 K "
R11	" -223	"	22 K "
C 1	QEK41CM-106	E Cap	10 16 V
C 2	QEK41HM-225	"	2.2 50 V
C 3	" -225	"	2.2 "
C 4	QFN41HJ-223	MY Cap	0.022 "
C 5	QEK41HM-225	E Cap	2.2 "
C 6	" -225	"	2.2 "
C 7	QEK41EM-336	"	33 25 V
C 8	QEM41EK-106	"	10 "
C 9	QET41EM-107	"	100 "
C10	QFN41HJ-333	MY Cap	0.033 50 V
L 1	PU55811-391	Coil	390 μ H
L 2	PU49994-120	"	12 μ H
CN 1	PU56258-8	Cap. Housing	
	PU56521	Shield Case (1)	
	PU56522	" (2)	
IB 1	PU35238-006	Inline Block	
TH 1	PU52108-2R2	Posistor	

6.2.5 Pre-amp board ass'y 06 PU35361A

Symbol No.	Part No.	Part Name	Description
IC 1	HA11782	Integrated Circuit	
Q 1	2SC2712Y	Chip Transistor	
Q 2	"	"	
Q 3	"	"	
Q 4	"	"	
R 1	PU57457-682	VR	6.8
R 2	" -682	"	6.8
R 3	QRS188 J-103	Chip R	10 K 1/8 W
R 4	" -103	"	10 K "
R 5	" -123	"	12 K "
R 6	" -123	"	12 K "
R 7	" -681	"	680 "
R 8	" -681	"	680 "
R 9	" -272	"	2.7 K "
R10	" -272	"	2.7 K "
R11	" -152	"	1.5 K "
R12	" -152	"	1.5 K "
R13	" -390	"	39 "
R14	" -390	"	39 "
R15	" -3R9	"	3.9 "
R16	" -3R9	"	3.9 "
R17	" -333	"	33 K "
C 1	QCY81EK-223ZL	C Cap	0.022 25 V
C 2	QER40JM-476	E Cap	47 6.3 V
C 3	QCY81EK-223ZL	C Cap	0.022 25 V
C 4	QER40JM-476	E Cap	47 6.3 V
C 5	QCY81EK-223ZL	C Cap	0.022 25 V
C 6	" -223ZL	"	0.022 "
C 7	" -223ZL	"	0.022 "
C 8	" -223ZL	"	0.022 "
C 9	" -223ZL	"	0.022 "
C10	" -223ZL	"	0.022 "
C11	" -223ZL	"	0.022 "
C12	" -223ZL	"	0.022 "
C13	PU57458-500	TR Cap	50 P
C14	" -500	"	50 P
C15	QCY81EK-223ZL	Chip Cap	0.022 25 V
C16	" -223ZL	"	0.022 "
C17	" -223ZL	"	0.022 "
C18	" -223ZL	"	0.022 "
C19	" -223ZL	"	0.022 "
C20	" -223ZL	"	0.022 "
C21	QER41HM-105	E Cap	1 50 V
C22	" -105	"	1 "
	PU56278	Test Pin	TP1, 2
L 1	PU53223-101G	Peaking Coil	100 μ H
L 2	" -101G	"	100 μ H
CN 1	PU56258-8	Cap. Housing	
	PU57459	Shield Case (1)	
	PU57460	" (2)	

6.2.6 Audio board ass'y 07 PU34674B

Symbol No.	Part No.	Part Name	Description
IC 1	AN3991K	Integrated Circuit	
IC 2	TA7361P	"	
IC 3	6VT02	"	
Q 1	—	—	
Q 2	—	—	
Q 3	2SD1330S,T	Transistor	
Q 4	—	—	
Q 5	DTC144F	D. Transistor	
Q 6	DTA124F	"	
Q 7	DTC144F	"	
Q 8	"	"	
Q 9	2SA1175H	Transistor	
Q10	2SC2787LF	"	
Q11	DTC144F	D. Transistor	
D 1	HZ11B2L	Zener Diode	
D 2	—	—	
D 3	1SS133	Diode	
R 1	QRD161J-222	CR	2.2 K 1/6 W
R 2	" -221	"	220 "
R 3	" -223	"	22 K "
R 4	" -393	"	39 K "
R 5	—	—	
R 6	—	—	
R 7	QRD161J-271	CR	270 1/6 W
R 8	—	—	
R 9	—	—	
R10	QRD161J-124	CR	120 K 1/6 W
R11	" -472	"	4.7 K "
R12	QVZ3531-222	VR	2.2 K "
R13	QRD161J-103	CR	10 K 1/6 W
R14	" -102	"	1 K "
R15	" -562	"	5.6 K "
R16	" -103	"	10 K "
R17	QVZ3531-103	VR	10 K
R18	QRD161J-151	CR	150 1/6 W
R19	—	—	
R20	QRD161J-273	CR	27 K 1/6 W
R21	" -822	"	8.2 K "
R22	—	—	
R23	QRD161J-223	CR	22 K 1/6 W
R24	" -562	"	5.6 K "
R25	" -332	"	3.3 K "
R26	" -823	"	82 K "
R27	" -121	"	120 "
R28	" -223	"	22 K "
R29	" -102	"	1 K "
R30	" -0R0	"	0
R31	QVZ3531-333	VR	33 K
R32	QRD161J-393	CR	39 K 1/6 W
R33	—	—	
R34	QRD161J-181	CR	180 1/6 W
R35	—	—	
R36	QRD161J-103	CR	10 K 1/6 W
R37	—	—	
R38	QRD161J-332	CR	3.3 K 1/6 W

6.2.7 OSC. board ass'y 09 PU56534A-2

Symbol No.	Part No.	Part Name	Description
C 1	QFN31HJ-122Z	MY Cap	0.0012 50 V
C 2	QEK61HM-334GZ	E Cap	0.33 "
C 3	QEP41HM-335	NP Cap	3.3 "
C 4	QEK60JM-476Z	E Cap	47 6.3 V
C 5	—	—	
C 6	—	—	
C 7	QFN31HJ-681Z	MY Cap	680 P 50 V
C 8	QEL61HM-474G	LL Cap	0.47 "
C 9	QEL61CM-106G	"	10 16 V
C10	—	—	
C11	QFN31HJ-223Z	MY Cap	0.022 50 V
C12	—	—	
C13	QEP61AM-106GZ	NP Cap	10 10 V
C14	QEK41HM-335	E Cap	3.3 50 V
C15	QEK61HM-335G	"	3.3 "
C16	" -224G	"	0.22 "
C17	QFN31HJ-822Z	MY Cap	0.0082 "
C18	" -473Z	"	0.047 "
C19	—	—	
C20	QEK61HM-474GZ	E Cap	0.47 50 V
C21	QEU41AM-227	"	220 10 V
C22	QFN41HJ-471	MY Cap	470 P 50 V
C23	QEK61HM-335G	E Cap	3.3 "
C24	QEK41HM-225	"	2.2 "
C25	QEK41AM-226	"	22 10 V
C26	QEK40JM-336	"	33 6.3 V
C27	" -226	"	22 "
C28	QER61CM-106GZ	"	10 16 V
C29	QEK61CM-476	"	47 "
C30	—	—	
C31	QEK60JM-476Z	E Cap	47 6.3 V
C32	QFN31HJ-471Z	MY Cap	470 P 50 V
C33	QFP32AJ-273	PP Cap	0.027 100 V
C34	QEK40JM-476	E Cap	47 6.3 V
C35	OCS31HJ-121	C Cap	120 50 V
	PQ40936	Sub Frame	
	SDSA3008Z	Tap. Screw	
L 1	PU56366	L.P.F. Coil	
L 2	PU54710-392	Coil	3.9 mH
L 3	PU53617	Osc. Coil	
L 4	PU48530-471J	Peaking Coil	470 μH
CN 4	PU49215-3	Cap. Housing	
CN 5	" -3R	"	
IB 1	PU33106-058	In-Line Block	
	PU56008	Test Pin	TP1, 2
J001	PU56367	Jack Board Ass'y	

Symbol No.	Part No.	Part Name	Description
IC 1	3VT01	Integrated Circuit	
Q 1	DTA124F	Transistor	
Q 2	DTC144F	"	
R 1	QRD167J-393	CR	39 K 1/6 W
R 2	" -391	"	390 "
C 1	QER41EM-226	E Cap	22 25 V
C 2	QFN41HJ-393	MY Cap	0.039 50 V
L 1	PU53618-471JF	Coil	470 μH
CN 1	PU56535-7	Recept. Housing	
CN 2	PU53587-3	Cap. Housing	
CN 3	PU54537-2R	"	
CN 4	" -2	"	
	PU56008	Test Pin	TP2
	PU56567	Supporter	

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